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STRELNIKOV (I.). **Wasserumsatz und Diapause bei** *Loxostege sticticalis*. [The Water Exchange and Diapause in *L. sticticalis*.]—*C. R. Acad. Sci. URSS*. N.S. 1936 **1** no. 6 pp. 267–271, 3 refs. Moscow, 1936.

Experiments were made in Leningrad to determine the dependence of the diapause in the larva of *Loxostege sticticalis*, L., on the amount of water contained in its body. For this purpose, larvae were fed from the beginning of the third instar onwards on *Artemisia austriaca* or from the beginning of the fourth on *Chenopodium album*, the conditions of humidity and water content of the plants being varied. Of the larvae on *A. austriaca*, those kept at 100 per cent. humidity and fed on plants with the normal 67 per cent. water content completed the 3rd–5th instars (up to spinning of the cocoon) in an average of 300 hours, and there was no diapause. Larvae kept at 70–75 per cent. humidity, and given plants with a reduced water content (60 per cent.) during the first 24 hours after each moult and normal plants for the rest of the time, completed the corresponding development in an average of 468 hours, and entered a diapause that lasted for over 10 months. Larvae kept at 70–75 per cent. humidity and fed on normal plants except for 2 successive days in their fourth instar, when they were fed on somewhat dry ones, developed in an average of 372 hours, and there was a diapause of over 10 months.

In the case of *C. album*, larvae fed on plants which contained 85 per cent. water completed the last two instars in 120–144 hours, or more quickly than those fed on *Artemisia* with 67 per cent. water content, and no diapause occurred. Larvae fed on *Chenopodium* with a water content of only 65–70 per cent. took an average of 336 hours for the two instars and remained in diapause for over 10 months.

In order to build up the protoplasm, the larva requires 85 per cent. water and 15 solids. If an insufficient amount of water is absorbed, the water present is bound by the protoplasm, this being the chief factor that causes diapause.

Larvae fed on such rich food as flowers of *C. album* were very heavy and entered a diapause. This indicates that the accumulation of substances in the body can also reduce the content of free water by binding it. Under natural conditions the diapause is brought about by insufficiently moist food, by food with an increased nutritive value, or by low temperature. In the author's experiments, diapause was produced at temperatures as high as 20–28°C. [68–82·4°F.] by feeding the larvae on dry food.

PETRI (L.). **Le alterazioni dei frutti degli agrumi.** [Injuries to *Citrus* Fruits.]—Oblong 18 × 13 cm., viii+44 pp., 63 col. pls. Rome, R. Staz. Pat. veg., 1933. Price *Lire* 40. [Recd. September 1936.]

This book comprises 63 plates printed in colour from water-colours by the author, showing the appearance of *Citrus* fruits injured by various agencies in Italy, including fungi and insects, and accompanied by brief notes on the character of the injury. It is of convenient pocket size and should permit a ready identification of the injurious agents.

BERGOLD (G.) & RIPPER (W.). **Wegweiser im Pflanzenschutz.** [A Guide to Plant Protection.]—64 pp., 1 fig. Vienna, the authors, 1936. Price 50 *gr.*

This booklet for Austrian growers includes spray and dust calendars for orchards, vines and beet, and a list of 740 pests and diseases of

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orchards, vines, vegetables and ornamental plants, and field crops, arranged alphabetically under popular names, but showing the scientific name and plants attacked in each case, with notes on measures for control.

[Bugdanov (G. B.).] **Бугданов (Г. Б.). An Attempt to estimate Losses caused by the European Corn-borer.** [*In Russian.*] —*Nauch. Trud. gorsk. zonal. s.-kh. op. Stantz.* no. 7, 11 pp. Ordzhonikidze, 1934. (With a Summary in English.) [Recd. 1936.]

As maize is an important crop in the northern Caucasus, and is heavily infested there by *Pyrausta nubilalis*, Hb., investigations were carried out in the foothill zone in 1933 to ascertain the loss that results from infestation. For this purpose, each of the plants cultivated over a total area of about 3,000 sq. yds. was examined every 5 days and the yield of seeds obtained from each plant was ultimately weighed after the seeds had been air dried. Of all the plants, 82 per cent. were infested. Among these, the percentages damaged in the cobs only, in both cobs and stems, and in stems only were 4, 31 and 65. The total percentage loss in weight of the air-dried seed caused by all types of injury together was 18·2. In the case of plants in which only one-third of the stalk was damaged, the highest percentage of loss in yield (22) occurred when the middle part of the stem was attacked. The percentage loss of total yield due to this type of injury was 1·2 as compared with 7 due to injury to the entire stem, which was the most common type. Infestation of the stems was of greater economic importance than infestation of the cobs. Of cobs infected with *Fusarium*, 60 per cent. were initially injured by the borer.

[Konakov (N.), Razumova (V.) & Kosheleva (T.). **Конаков (Н.), Разумова (В.) и Кошелева (Т.). Ueberblick der Schattenlaubschädlinge in der Stadt Woronesh im Jahre 1934.** [Survey of the Pests of Shade Trees in Voronezh in 1934.] [*In Russian.*]—*Acta Univ. Voroneg.* **8** no. 3 pp. 82–97, 1 graph, 13 figs., 27 refs. Voronezh, 1935. (With a Summary in German.) [Recd. 1936.]

A list is given of 47 species of insects observed on trees and shrubs in Voronezh in 1934. The 15 considered of economic importance included *Leucoptera* (*Cemiostoma*) *susinella*, H.-S., which mined in the leaves of *Populus candicans* and had two generations during the summer. This moth does not appear to have previously been recorded in the Russian Union.

[Stepanov (E. M.).] **Степанов (Е. М.). The biological Method of controlling Pests of Plants in Abkhazia.** [*In Russian.*]—Med. 8vo 80 pp., 24 figs., 6 refs. Sukhum, Abkhazsk. Punkt Karant., 1935. Price 2 *rub.* [Recd. 1936.]

A detailed account is given of the work on biological control carried out in 1932–34 in the Republic of Abkhazia on the Black Sea Coast of Transcaucasia. Against *Eriosoma lanigerum*, Hsm., on apples, *Aphelinus mali*, Hald, was introduced from the Crimea [*cf. R.A.E.*, A **21** 633] in 1932 and rapidly increased in numbers, producing 10–11 generations a

year. In 1933 it had spread all over Abkhazia, every colony of *Eriosoma* being parasitised. As a result, the yield of apples has considerably increased.

Icerya purchasi, Mask., was discovered in a park in Sukhum in 1931, and in spite of the destruction of infested plants, particularly *Acacia dealbata*, which is very common in the country, a severe outbreak occurred in the spring of 1933 in several places. The scale was found on *Citrus* trees, but only when they were close to infested *Acacia*, and it bred more readily on the latter than on any other plant. The outbreak, however, was completely controlled by the Coccinellid, *Rodolia* (*Novius*) *cardinalis*, Muls., which was introduced from Leningrad in 1932 and successfully overwintered in the field. It was also reared in the laboratory and liberated as required. As a result, only single individuals of *I. purchasi* occurred in and near Sukhum up to November 1934. In the second half of the summer of 1934, however, ants of the genus *Lasius* appeared in numbers wherever *I. purchasi* was present and protected the females from the attacks of the Coccinellid by building shelters of earth over them. Thus some scales may survive to form new foci of infestation, and in view of this the breeding of *R. cardinalis* has been continued in the laboratory.

Of the mealybugs that occur in Abkhazia, *Pseudococcus gahani*, Green, which causes severe shedding of the fruit and foliage of *Citrus*, is the most important. It has only been found in the town of Sukhum, but occurs on a large variety of plants and may be easily carried to uninfested localities by animals or on the clothes of man. *P. maritimus*, Ehrh., is widely distributed along the sea coast on a number of plants, but chiefly on *Acacia*. *Citrus* is infested, but not severely. *P. citri*, Risso, usually attacks figs and vines in Abkhazia, and has not been observed by the author on *Citrus*. It is sometimes very heavily parasitised by Chalcidoids. *P. adonidum*, L., has been found on various plants, but only in nurseries in which no control measures have been carried out.

In Abkhazia, an important enemy of *P. gahani* and *P. maritimus* is the larva of a new genus and species of Cosmopterigid, which completes its development and pupates among the mealybugs. The larvae are most numerous at the end of November and beginning of December, and sometimes destroy 50 per cent. of the hibernating eggs of *P. maritimus*. The larvae of *Chrysopa vulgaris*, Schn., often attack *P. gahani*, but are not numerous enough to effect any appreciable control. In trap bands, large numbers of the females and eggs of *P. gahani* are destroyed by woodlice, especially in the autumn during the rains.

A consignment of the Coccinellid, *Cryptolaemus montrouzieri*, Muls., was brought from Leningrad for the control of *P. gahani* in the autumn of 1933, and after rearing in a greenhouse during the winter, liberations were made in a severely infested *Citrus* orchard early in the following spring. The behaviour of the adults and larvae is described. Observations showed that larvae about to pupate congregate under the trap bands placed on the trees against the mealybug ; it is desirable, therefore, that there should be a sufficient number of such bands in the orchard. It was found much better to release adults of the Coccinellid rather than larvae, as they soon produce sufficient offspring to clear the tree, selecting for oviposition places where the mealybugs are most numerous. Complete control was secured by releasing 15–20 adults on a severely infested tree or 10 on a slightly infested one. The Coccinellid thrived throughout the summer and autumn, without being affected by high

humidity, torrential rain, or a maximum temperature of 35°C. [95°F.]. During the hot weather in July the life-cycle was completed in 29 days, whereas it required 51 days at lower temperatures in August–September. The adults and larvae were active on warm days in winter and only completely disappeared by the end of January. The beetles did not spread rapidly, requiring a month to cover about 22 yards ; it is therefore desirable to liberate a few on every tree in the orchard so as to establish a number of breeding foci, and to supplement this by collecting larvae from the trees on which they are numerous and transferring them to those on which they are scarce or absent.

Up to 30 per cent. of the pupae of *C. montrouzieri* were sometimes parasitised by *Pseudocatolaccus* sp., a Pteromalid that usually attacks the pupae of *Chilocorus bipustulatus*, L., which is very common in Abkhazia and congregates wherever large colonies of Coccids are present. The larvae were destroyed by *Chrysopa vulgaris*, and those on fallen leaves by the Carabids, *Harpalus rufipes*, Dej. (*Ophonus pubescens*, Müll.), and *Carabus septemcarinatus*, Motsch.

In the course of the work, larvae of *C. montrouzieri* were observed to feed in the orchard on the adult females and especially the egg-sacs of *Pulvinaria aurantii*, Ckll., which is a serious pest of *Citrus* in Abkhazia. In insectaries they completed development on this scale and cleared the trees from infestation.

PRÜFFER (J.). **Charakter rójki chrabąszczy w Polsce w roku 1935.** [The Character of the Flight of Cockchafers in Poland in the Year 1935.]—*Roczn. Ochr. Rośl.* **3** pp. 11–16. Warsaw, 1935. (With a Summary in German.) [Recd. 1936.]

In 1935 cockchafers, chiefly *Melolontha melolontha*, L., were very numerous in the south-east of Poland, but absent in other parts of the country except for small isolated areas. Brief notes are given on the local incidence of the swarms. No flight should be expected in the greater part of Poland in 1936, but adults of *M. hippocastani*, F., may occur in some parts of the north-east, where it probably has a five-year life-cycle.

JEZ (S.). **Płaszczyniec burakowy czyli pluskwa burakowa** (*Piesma quadrata* **Fieber**). [The Beet Bug, *P. quadrata*.]—*Roczn. Ochr. Rośl.* **3** separate no. 3, 18 pp., 8 pls., 5 refs. Warsaw, 1936. (With a Summary in German.)

In Poland, the leaf-crinkle disease of beet first appeared in 1930 in the east of the Department of Poznan and then spread westward, covering an area of 6,400 sq. miles by 1935, when *Piesma quadrata*, Fieb., which transmits the virus, was first observed. This Tingid had evidently migrated from German Silesia and the severity of the infestation in Poland, which in some cases reduced the yield of beet by over 50 per cent., led to a study of its bionomics, a detailed account of which is given [*cf. R.A.E.*, A **17** 640, etc.], with descriptions of all stages. In 1935 the hibernating adult bugs were found in large numbers under débris and fallen leaves at the foot of trees and telegraph poles and near heaps of stones. They were active on 25th April at a temperature of 22°C. [71·6°F.] and again, after an interruption due to cold, for the 3 weeks following 5th May. In beet fields they were most numerous near

ravines, paths or forest borders, but spread for considerable distances when their flight was aided by wind. Eggs were first found on 10th May and nymphs 19 days later. The first young adults occurred on 1st July and some had entered hibernation by the end of the month, but others, together with eggs and nymphs of a second generation, were found until 10th October. It was not ascertained whether the second generation nymphs were able to complete their development in the autumn. In the laboratory the bugs fed on cereals, clover and a number of other plants, besides all varieties of beet.

The method found most effective for safeguarding fields from infestation was sowing belts of trap beet round them in spring. The beet in the field should not be sown until the flight of the bugs from their hibernation quarters is over and they have been destroyed on the trap crop by ploughing it in to a depth of 8–12 ins., and rolling the ground. The best time for ploughing is early morning, when the bugs are sluggish.

PRONIN (J.). **Biologiczna rola osiki w zespole leśnym.** [The Biological Rôle of Aspen in Forest Association.] [*In Polish.*]—*Ochr. Przyr.* **15** pp. 90–95, 4 figs. Cracow, 1935. (With a Summary in German.) [Recd. 1936.]

The aspen (*Populus tremula*) is attacked by a number of insects that do not infest other trees, with the exception of willows (*Salix*). In mixed forests, these insects act as hosts for numerous Ichneumonid and Tachinid parasites that also attack insect pests of other trees, so that aspens are of considerable use as a breeding ground for parasites. A preliminary list is given of 66 species of insects the larvae of which attack *Populus* and *Salix*.

DIMITRU (F. L.). **Contribuţiuni la biologia Cetonidului** *Epicometis* (*Tropinota*) *hirta* **Poda.**—*Anal. Inst. Cerc. agron. Român.* **7** (1935) pp. 209–232, 19 figs., 75 refs. Bucarest, 1936. (With a Summary in German.)

In Rumania, and especially in the plains, adults of the Cetoniid, *Epicometis hirta*, Poda, sometimes occur in such numbers in late April and May that they cause an entire loss of the fruit crop by feeding on the blossoms. In June they begin to disappear, though a few may be seen even in August. They prefer to feed on flower buds and blossom organs, but, if these are not available, attack leaf-buds or tender leaves and often the immature ears of cereals. The female oviposits in ploughed, loose, sunny soil, usually laying 1–4 eggs daily. Observations showed that the optimum temperature for oviposition is 21·5–24°C. [70·7–72·2°F.] ; at 30°C. [86°F.] the beetles did not live so long or lay so many eggs. The eggs are laid singly, usually at a depth of 1¼–2 ins., but nearer the surface if the temperature is 30°C. Dry or saturated soils are unsuitable. The larvae, which usually complete their development in 56–65 days, feed on thin grass roots, half decayed larger roots and particles of soil. They require a certain amount of moisture, their development being very slow in dry soil. They pupate between mid-July and mid-August, and metamorphosis is completed soon afterwards, but the adults remain in their pupal cases until the following spring.

KNECHTEL (W. K.) & MANOLACHE (C. I.). **Observaţiuni biologice asupra gândacului ovăzului** *Lema melanopus* **L. în România.** [Biological Observations on *L. melanopa* in Rumania.]—*Anal. Inst. Cerc. agron. Român.* **7** (1935) pp. 186–208, 13 figs., 56 refs. Bucarest, 1936. (With a Summary in German.)

The Criocerid, *Lema melanopa*, L., is one of the most dangerous pests of cereals, especially oats, in the plains of Rumania, the injury in some localities reducing the crop by 80 per cent. Oats and barley are the preferred food-plants, but wheat, rye, maize and various grasses, a list of which is given, are also attacked. The adults appear in spring at a temperature of 9·5–10°C. [49·1–50°F.], pair after 4–5 days, and oviposit in early May or in April if the temperature is high. The eggs are laid on the leaves of cereals at the rate of 8–50 per leaf and hatch in 10–12 days. The larvae are active for 14–15 days, and the prepupal and pupal stages in the soil last 16–18 days. Pupation occurs at a depth of 1½–2 ins. The adults emerge in the last ten days of June or early July, and seek their winter quarters in September, in forest litter, under grass, etc.

Natural enemies of the larvae include the parasites, *Anilastus* sp., *Thersilochus* sp., and *Tetrastichus* sp., and the predacious bug, *Nabis ferus*, L. *Chrysopa* sp. attacks the eggs. In experiments on control nicotine sprays were effective, but their cost is high. Dusting with calcium arsenate killed 90 per cent. of the larvae.

GEHLSEN (C. A.). **Derris (Tubawurzel).**—*Tropenpflanzer* **39** no. 8 pp. 345–352, 5 refs. Berlin, August 1936.

This is an account from the literature of the history, botany, cultivation and properties of derris and of the methods of using it as an insecticide. A brief note on barbasco root (*Lonchocarpus* sp.), which is another source of rotenone, is included.

KUNIKE (G.). **Holzschädlinge und ihre Bekämpfung.** [Wood Pests and their Control.]—*Anz. Schädlingsk.* **12** no. 8 pp. 89–95, 25 figs. Berlin, August 1936.

An account is given of the infestation of timber in buildings in Germany by *Hylotrupes bajulus*, L., followed by brief notes on a number of other pests of wood that have been found indoors. They include *Camponotus ligniperda*, Latr., which makes nests in beams and weakens them, and the Cerambycid, *Gracilia minuta*, F., which injures the wicker covers of demijohns holding acids or inflammable liquids and can thus cause dangerous accidents.

ROESLER (R.). **Herzlosigkeit an Blumenkohl durch Blasenfüsse (Thrips).** [The Destruction of the Heart in Cauliflowers by Thrips.]—*Anz. Schädlingsk.* **12** no. 8 pp. 95–97, 2 figs. Berlin, August 1936.

Insects that prevent the formation of a heart in cauliflowers in Germany include *Ceuthorrhynchus quadridens*, Panz. [*cf. R.A.E.*, A **23** 705], cutworms, which eat out the heart leaves, and Aphids, which if abundant cause the heart leaves to die. Of recent years, *Thrips tabaci*, Lind., has been a serious pest in Saxony and elsewhere in Germany, especially in the summer of 1935, when it destroyed up to 80 per cent.

of the plants in some fields. The cauliflowers concerned were those planted out late, in July. The infestation began in the seedling frames, but did not become visible until the outer heart leaves opened, disclosing only a smooth scar instead of the heart. It was then too late to apply measures for control, but repeated spraying of the seedlings in the frames with nicotine-soap is suggested. It is pointed out that the injury done by *Contarinia torquens*, de Meij., is different, as the heart-leaves are luxuriantly developed but crinkled, and the sprout axis and leaf-stalks are twisted.

Balachowsky (A.) & Viennot-Bourgin (L.). **Recherches sur le comportement du carpocapse en vue de l'établissement rationnel des traitements insecticides dirigés contre cet insecte.**—*C. R. Acad. Agric. Fr.* **22** no. 22 pp. 783–788, 2 refs. Paris, July 1936.

As a result of investigations lasting over four years, some general observations are given on the seasonal history of the codling moth [*Cydia pomonella*, L.] in orchards in France. In the district round Paris and in all the temperate districts of central and western France, the adults of the overwintering generation do not appear before the second week in May, irrespective of the weather during the year. The moths continue to emerge until about the beginning of August where there is one generation a year (as round Paris), and longer where there are two (as in most of the southern districts). The peak of emergence generally occurs from early June to early July. Throughout the temperate districts infestation of the fruit in the orchards never occurs before 1st June, whatever the weather. It increases rapidly after the second week in June until mid-July. Experiments have again confirmed that oviposition, which takes place on damp, calm evenings, only occurs when the temperature at twilight is more than 15°C. [59°F.]. Thus maximum infestation of the fruit does not always correspond with the time of maximum flight, and the numbers of adults trapped by baits of molasses would not indicate the time for spraying with sufficient accuracy. Treatments against the codling moth should begin from 1st June in all orchards in the central and western region, and should be repeated at intervals over two months. Five sprays in all are required if lead arsenate is used alone, but only three, or even two, if an adhesive or summer oil is used with it.

Vayssière (P.). **Etat des recherches sur les sauterelles migratrices.**—*Rev. Ass. franç. Sci.* **64** no. 3 pp. 111–118. Paris, 1936.

An outline is given of the international organisation of anti-locust research [*cf. R.A.E.*, A **20** 160 ; **21** 51 ; **22** 704–709] and in particular of the work carried out by the French entomologists in West Africa [*cf.* **22** 708].

Bouhélier (R.) & Foury (A.). **Contribution à l'étude des appâts dans la lutte contre la cératite** (*Ceratitis capitata* **Wied.**).—*Rev. Zool. agric.* **35** no. 4 pp. 49–63, 1 pl. Bordeaux, April 1936.

The results are given of a series of comparative tests of various baits for *Ceratitis capitata*, Wied., which were undertaken in Morocco in 1935. A description is given of the cage used in the experiments. In it were placed several partly crushed grapes and a small glass jar containing

the bait, which, in order to reduce death by drowning, was filled with fragments of glass that projected above the surface. When possible, flies were used on the day of their emergence, and a control experiment (in a cage containing grapes only) was started simultaneously. The dead flies were removed each day, but in no case was the bait renewed, although water lost by evaporation was replaced. Many of the experiments were duplicated. The percentage mortality obtained in 7 days and the time required to produce total mortality were ascertained in each case. More flies attacked each of the baits than the natural food, and mortality was always greater and more quickly attained in the tests than in the control experiments.

In a mixture of 14 lb. molasses and 10 gals. water, 0·5 lb. lead arsenate paste or 0·07 lb. sodium arsenite gave good results, 0·2 lb. sodium fluosilicate being less effective. The time required for complete mortality in duplicate tests was not so regular with lead arsenate as with sodium arsenite. The addition of oil of anise or cedar oil apparently reduced the attractiveness of the lead arsenate bait. Ammonium fluoride or bifluoride (2 lb. with 5 lb. molasses and 10 gals. water) both gave very good but irregular results. Molasses with white sugar and copper carbonate, with nicotine sulphate, or with derris was unsatisfactory. Sugar, either as a lump dipping into a solution of sodium arsenite or as a syrup with sodium fluosilicate, gave good results, as did a bait of borax, sodium arsenite and water in which coarse flour (middlings) had been steeped [*cf. R.A.E.*, A **24** 621, etc.]. Good results were also given by the juice of Muscat grapes and borax with lead arsenate or sodium arsenite (particularly the latter), and both were better than peach juice with borax and sodium arsenite. Borax and sodium fluosilicate with Muscat grape juice, however, was less satisfactory than with peach juice, which was very effective. A 3 per cent. solution of Clensel in water was attractive, but gave a low mortality ; with the addition of sodium arsenite better but less regular results were obtained.

PERRET (J.). **Observations sur *Epilachna chrysomelina* Fabr. coccinelle du melon.**—*Rev. Path. vég.* **23** fasc. 3 pp. 177–184, 1 fig., 4 refs. Paris, 1936.

An account is given of the bionomics and control of *Epilachna chrysomelina*, F., in Morocco, where it damages melons and other cucurbits. After a preoviposition period of about 3 weeks, females lay 100–200 eggs in batches of 1–40 on the under side of the leaves in the course of 20–30 days. The eggs hatch in 3–6 days, and the larvae pass through 4 instars lasting 3–5, 1–3, 2–8, and 5–11 days, respectively. Pupation generally takes place on the leaves, and the pupal stage lasts 3–7 days. Three generations occur during the year, the last of which hibernates in the adult stage from September–November until the following March. Hibernation always occurs above ground level. It does not appear to depend on temperature, which is frequently high during September, but is probably connected with the state of vegetation of the plant. All parts of the plant are attacked, but particularly the leaves. Later in the season, as the leaves become dry, deep holes are bored in the flesh of young fruit. The damage is especially severe at the time of emergence of the adults of the overwintering generation, when the plants are young, and of the adults of the second generation

(in June and July), which are so numerous that they weaken the plants and check the production of fruit.

Control by collecting the adults and older larvae and crushing the eggs and younger larvae is not satisfactory, as many eggs and adults escape observation, and more labour is necessary than is justified by the crop. In experiments, sprays containing barium fluosilicate and lead arsenate were useless owing to the poor coverage given, and even with the addition of adhesives only a few young larvae were killed. A dust containing 25 per cent. sodium arsenite was cheap, did not injure the plants and gave a mortality of 100 per cent., but cannot be used, owing to legislative restrictions. One containing 35–50 per cent. sodium fluosilicate with lime give 80-100 per cent. mortality, but with a greater proportion of fluosilicate the dust did not adhere. A mixture of barium fluosilicate (25 per cent.) and talc gave 90–100 per cent. mortality, but one containing less fluosilicate was not satisfactory. Barium fluosilicate adheres well and should be applied as a thick cloud that settles on the leaves.

Bonnemaison (L.). **Morphologie comparée du " Pou de San José " (*Aonidiella perniciosa* Comst.) et de l'*Aspidiotus* des arbres fruitiers (*Aspidiotus ostreaeformis* Curtis).**—*Rev. Path. vég.* **23** fasc. 3 pp. 230–243, 9 figs., 5 refs. Paris, 1936.

Second-instar larvae of *Aspidiotus ostreaeformis*, Curt., which is indigenous in France, have often been confused with adults of *Aonidiella perniciosa*, Comst., which does not occur there. A comparison is therefore made of the morphology of the second-instar larvae and the adult females of both species, including both macroscopic and microscopic characters, together with a brief note on the male pupae. Characters distinguishing *Aspidiotus zonatus*, Frnf., from *Aonidiella perniciosa*, which it resembles slightly, are also given.

Balachowsky (A.). **Sur la présence d'*Anuraphis persicae-niger* Smith dans l'ouest de la France.**—*Rev. Path. vég.* **23** fasc. 3 pp. 258–259, 7 refs. Paris, 1936.

Anuraphis persicae-niger, Smith, which has already been reported from peach in the Rhône valley and the Midi [*R.A.E.*, A **20** 441], has recently been observed in the west of France. The flowers, leaves and young shoots of several young peach trees were completely destroyed. This Aphid will probably be found in many other localities where injury by it has been attributed to the indigenous *A. schwartzi*, Börner (*persicae*, Boy.).

Jary (S. G.). **Pyrethrum.**—*J. S.-E. agric. Coll.* no. 38 pp. 59–66, 1 fig., 2 refs. Wye, Kent, July 1936.

An account is given of the planting, general management and crop yields, extending over seven years, of a half-acre plot of pyrethrum (*Chrysanthemum cinerariaefolium*) at Wye [*cf. R.A.E.*, A **20** 553]. Observations are recorded on the effect of various distances of planting and the influence of the parent plant on the type of seedlings raised. A pyrethrin content was maintained that compares favourably with that of flowers grown in other countries, and is appreciably higher than

that of many commercial samples, probably because the figures given are strictly for flower heads, small pieces of stalk, etc., being removed on evaluation.

JARY (S. G.) & STAPLEY (J. H.). **Investigations on the Insect and Allied Pests of Cultivated Mushrooms—VI. Observations upon the Tyroglyphid Mite** *Histiostoma rostro-serratum*, **Mégnin.**—*J. S.-E. agric. Coll.* no. 38 pp. 67–74, 4 figs., 6 refs. Wye, Kent, July 1936.

An account is given of observations on *Histiostoma rostroserratum*, Mégn., which is common in damp vegetable refuse or fresh stable manure in Britain, and often occurs on mushroom beds. Apparently it does not injure mushrooms, as it did not devour the colonies of small fungi that sometimes appeared in the breeding cells, although other Tyroglyphids did so. It seems probable that its food is chiefly of a semi-liquid nature and consists of the contents of decomposing plant cells. The immature stages, including the hypopus, are described, and also the life-cycle, which was obtained from laboratory breeding experiments, using horse-dung. In mushroom beds, to which the mites are transferred in wet stable manure, they are found mostly in the hypopial stage unless many semi-decaying mushrooms are present. Evidence is presented that parthenogenetic reproduction occurs in this species, and that the progeny are invariably males.

BARNES (H. F.). **Almond and Peach Buds attacked by a Gall Midge in Greece.**—*J. S.-E. agric. Coll.* no. 38 pp. 75–77, 1 fig. Wye, Kent, July 1936.

Descriptions are given of both sexes of *Odinadiplosis* (*Cecidomyia*) *amygdali*, Anagnos., and its generic placing is briefly discussed. This Cecidomyiid is only known to occur in Greece (Attica), where it causes serious injury by infesting the buds of almond. Swelling and multiplication of the buds in the axil of the leaves begins after the development of the twigs in the spring and reaches its height in July. Only a few of these buds give flowers in the following spring, and these do not produce fruit. Continued attacks kill the trees, as the food materials are drained by the production of the buds. Half-wild peach is similarly attacked. The adult midges appear during April and early May, and the females lay 5 eggs in the axil of each leaf. One larva is found in the base of each false bud, and remains there throughout the year. Pupation occurs in the buds at the end of the following March. There is only one generation in a year.

AUSTIN (M. D.) & PITCHER (R. S.). **Investigations on the Insect and Allied Pests of Cultivated Mushrooms—VII. Some Diagnostic Characters used in the Determination of** *Sciara* **spp. (Family Mycetophilidae) associated with Cultivated Mushrooms.**—*J. S.-E. agric. Coll.* no. 38 pp. 78–82, 7 figs., 2 refs. Wye, Kent, July 1936.

A general description is given of the male hypopygium of a fly of the genus *Sciara* and of the technique of preparing it for examination, together with details of the characters of importance in identification of the hypopygia of five species that have been reared from larvae

infesting cultivated mushrooms in England, *viz.*, *S. agraria*, Felt, *S. auripila*, Winn., *S. fenestralis*, Zett., *S. umbratica*, Zett., and *S. vivida*, Winn.

PITCHER (R. S.). **Investigations on the Insect and Allied Pests of Cultivated Mushrooms—VIII. Observations on the Larval Instars of *Sciara fenestralis*, Zett.**—*J. S.-E. agric. Coll.* no. 38 pp. 83–85, 2 refs. Wye, Kent, July 1936.

Observations are recorded on the larval instars of *Sciara fenestralis*, Zett., supplementing previous work on its life-history [*R.A.E.*, A **21** 489]. From January to June, 1935, flies were taken from mushroom houses while pairing and placed in tubes containing stable manure for oviposition. Single females laid up to 120 eggs, with an average of 50–80. Under the conditions of rearing (on pellets of moist powdered manure at 22–23°C. [71·6–73·4°F.]) the larval period lasted 19–28 days, with an average of 23–24, and decreased with the approach of summer. There were four instars, lasting 5–8, 2–3, 3–4, and 9–12 days respectively, succeeded by a short prepupal stage of not more than 1 day. A brief description of the 4th instar is given. The duration of this instar varies considerably in nature, since unfavourable conditions, such as lack of moisture, cause periods of inactivity that delay maturity. The measurements of the width of the head capsules of the different instars conformed roughly to Dyar's Law, the ratio being 1·33.

ROLFE (S. W.). **Three Weevils of the Genus *Rhynchites* injurious to Fruit.**—*J. S.-E. agric. Coll.* no. 38 pp. 86–94, 9 figs., 12 refs. Wye, Kent, July 1936.

Three species of *Rhynchites* have been recorded as injurious in England in recent years, *R. coeruleus*, DeG., and *R. aequatus*, L., on apple [*cf. R.A.E.*, A **21** 138] and *R. germanicus*, Hbst., on strawberry. Brief descriptions of the adults of these weevils are quoted, and notes are given on their life-histories under insectary conditions. Adults of *R. coeruleus* appear in early May, and oviposition in shoots of hawthorn [*Crataegus*] or apple 2–3 mm. in diameter continues until early June. Most of the infested twigs contained only one egg per shoot. The female cuts halfway through the shoot just below the oviposition puncture so that it hangs down and soon falls off. The eggs hatched in 8–9 days, and the larvae fed on the inner tissues of the shoots until these decayed. The larval stage, which apparently comprised 3 instars, lasted about 10–12 weeks. Pupation occurred in the decayed stems or in cells a little below the surface of the soil, and lasted about 10 days. The adults emerged in the first half of September but apparently do not feed before hibernation. Some of the larvae overwinter in the stems or the soil, and in the insectary a few of those that hatched in 1934 remained as larvae in such situations throughout 1935, but it is doubtful if this occurs in the field. The injury caused has only been of importance on young apple trees, the young shoots of which should grow unchecked.

R. aequatus was noted as a pest of apples in 1910, and damage has lately increased in some localities. The weevils fly in May and June, and were abundant on hawthorn about 10th May in 1935. In the insectary oviposition occurred on the developing fruits and other parts of hawthorn about 21st June, but it was not noticed in the field. Apples

received in June from one locality in Kent were punctured [*cf. loc. cit.*] and up to three eggs per apple were present in most of them. Apples received later had many punctures but few eggs, as probably the younger apples in which eggs had been deposited had already fallen. The larvae hatched in about 8 days and fed in the apples ; some lived for at least 9 weeks. Those removed for observation died from fungus attack. Young apples in which oviposition occurs probably fall without developing, but damage of the larger fruit is mostly by feeding.

R. germanicus infested strawberries in Sussex during 1934 and 1935. Its oviposition habits are similar to those of *R. coeruleus*. Both leaf and flower stalks were cut, but more frequently the former, and 1–4 eggs were deposited in each. They hatched in about 3 weeks, but this period may have been increased by the change in conditions due to transfer of field material to the insectary. The larval stage lasted about 7 weeks. Pupation took place in the soil, and the pupal stage was short, but the adults remained in the pupal cells until the following spring, emerging in early April. Six of the weevils that emerged in 1935 killed a strawberry plant in a pot in less than three weeks, feeding almost entirely on the undersides of the leaves. No oviposition occurred. At present this insect is not a serious pest, but may become so if it increases in numbers.

Control measures for these weevils include destruction of cut shoots and the fallen fruit in which eggs have been deposited, and jarring the the trees to dislodge adults of *R. coeruleus* and *R. aequatus* [*cf.* **21** 634]. Lead arsenate sprays do not give satisfactory control of *R. aequatus*, as the weevils do little superficial feeding, but derris dusts seem to be effective [*cf.* **23** 426].

ANDERSON (J. A. T.). **Gall-midges (Cecidomyidae) whose Larvae attack Fungi.**—*J. S.-E. agric. Coll.* no. 38 pp. 95–107. Wye, Kent, July 1936.

The species of Cecidomyiids that infest fungi are shown in a briefly annotated list, with references to the literature, including in every case that to the original description. A list is also given of the fungi attacked, indicating the species infesting them and the countries in which the records were made.

HOOPER (C. H.). **Plums—Notes on their Pollination, Order of Flowering of Varieties and Insect Visitors to the Blossoms.**—*J. S.-E. agric. Coll.* no. 38 pp. 131–140, 19 refs. Wye, Kent, July 1935.

Few plums mature if insects are excluded from the blossoms, as more than a third of the varieties of plum are self-sterile. The author enumerates the different varieties, with their periods of flowering and percentages of self-fruitfulness, and also gives lists of insects observed visiting plum-blossoms at Wye and Wisley. It is important for self-pollination and cross-pollination that the insects should keep to the same kind of fruit-blossom, and according to A. W. Bennett, honey-bees, bumble-bees, flies and butterflies do so in that order.

KEARNS (H. G. H.), MARSH (R. W.) & MARTIN (H.). **Combined Washes. Progress Report. II.**—*Rep. agric. hort. Res. Sta. Bristol 1935* pp. 37–48, 6 refs. Bristol [1936].

Field trials of combined washes, a certain number of which were rendered inconclusive by May frost, were continued near Bristol during

1935 [*cf. R.A.E.*, A **23** 628]. In tests of the effect on black currant bushes of combinations of petroleum oil and lime-sulphur designed to control the green Capsid (*Lygus pabulinus*, L.) and big bud mite [*Eriophyes ribis*, Nal.], 5 groups of bushes were sprayed on 5th April when the buds were just exposed, with different washes, and 2 left as controls. A refined and a semi-refined white oil having 98 and 74 per cent. unsulphonated residue, respectively, and conforming to grade G and grade E specifications as given in a paper already noticed [**23** 497] were used at 5 per cent. concentration plus 8 per cent. lime-sulphur or alone. Sprays containing the refined oil and lime-sulphur alone caused no injury to the bushes. Those sprayed with the less refined oil showed signs of retarded growth after 19 days, and a month later most of the leaves showed marginal scorch. Frost interfered with accurate recording but it was evident that the use of the inferior oil had reduced the crop. In other experiments the refined oil spray alone or with lime-sulphur caused no damage to black currant bushes and gave a good initial control of the apple Capsid, *Plesiocoris rugicollis*, Fall., but the later effects could not be determined on account of the large numbers of Capsids migrating from neighbouring unsprayed bushes. It was impossible in one season to estimate the degree of control of big bud.

Tests were carried out in two centres to determine whether a satisfactory control of Capsids on apple could be secured by a combined wash of oil and lime-sulphur applied as late as the " green flower " stage. In one trial all trees were sprayed with a tar oil preparation at 6 per cent. on 10th March. Some of the trees were sprayed on 6th April with a petroleum oil preparation conforming to the grade E type S.E. IIa specification at a strength corresponding to 5 per cent. oil, and on 17th April with 3 per cent. lime-sulphur. The remaining trees were sprayed on 16th April at the early " green flower " stage with a refined grade G oil at 5 per cent. concentration emulsified with sulphite lye and mixed with 3 per cent. lime-sulphur. The combined wash caused no spray damage and appeared to be no less effective in the control of Capsid and scab than the separate sprays. In the second experiment 3 plots were sprayed with tar oil at 6 per cent. in February and with the combined wash at mid " green flower " stage on 23rd April, and 2 plots were sprayed with a preparation of tar and petroleum oils at 12 per cent. on 21st March and 3 per cent. lime-sulphur on 23rd April. The combined wash failed to control Capsid, which badly injured the foliage, but the combination of tar and petroleum oil applied a month earlier gave good control. It is possible that the inconsistent results with the combined spray of oil and lime-sulphur were due to the different dates of application.

Preliminary experiments were carried out in 1934 to investigate the possibility of obtaining extracts of derris and *Lonchocarpus* roots that would provide an insecticide comparable in efficiency and stability to the ground roots, and of preparing sprays easily from the extract. Rotenone was taken as the basis for comparison. In Worcestershire, apple trees infested by *P. rugicollis* and *Cheimatobia brumata*, L. (winter moth) were used to compare rotenone and nicotine as constituents of the lime-sulphur petal fall spray. The washes, which were applied in drenching amounts on 17th May, were composed of 8 oz. nicotine, or 1·2 oz. rotenone in 1·18 pint acetone, with 1·5 gals. lime-sulphur and 1 lb. sulphonated lorol to 100 gals. The acetone solution (5·13 per cent.) of rotenone was added to the dilute solution of lime-sulphur and sulphonated lorol. Capsid nymphs and half-grown winter-moth larvae

taken immediately after spraying with rotenone were all moribund 15 hours later, while the nicotine proved equally effective on the Capsids but killed only 50 per cent. of the caterpillars. Experiments having shown that ground derris root applied one week after petal fall provided a control of apple sawfly [*Hoplocampa testudinea*, Klug] equal to that obtained with a nicotine wash, a field trial was made to compare the efficiency of single applications of rotenone and nicotine on 28th May and of 2 applications of rotenone, the second on 4th June. The eggs hatched in numbers on 2nd June. The spray formulae were the same as in the previous experiment, except that 8 oz. lethalate wetting preparation was used instead of the sulphonated lorol. The average infestation of blossom with sawfly eggs on 28th May was 18 per cent. On 28th June there were 21 per cent. infested fruitlets on unsprayed trees, and 5·3, 8·9 and 6·2 per cent. on those receiving nicotine and single and double applications of rotenone, respectively. In a second trial, infestation of 28·3 per cent. on control trees was reduced to 2·99 per cent. by nicotine, 4·84 per cent. by rotenone and 8·2 per cent. by derris root (2·5 lb. ground derris root and 1·5 gals. lime-sulphur to 100 gals.). In these sprays the wetting agent was 1 lb. Agral N per 100 gals. They were applied on 22nd May, 4 days after petal fall, and most of the eggs had hatched by 3rd June. In 1935 a trial was made of the relative efficiency of a nicotine and lime-sulphur wash (8 oz. and 1·5 gals. to 100 gals.) combined with 8 oz. sulphonated lorol or with 1 gal. refined petroleum oil emulsified with 4 pints 20 per cent. sulphite lye (60° Tw.). One row of trees was sprayed with a proprietary preparation containing an emulsified derris extract. The washes were applied on 26th May, 3 days after petal fall and 8 days before the eggs hatched. All the eggs hatched, but all the sprays, acting as stomach poisons, gave excellent control of the larvae.

Kearns (H. G. H.) & Martin (H.). **Investigations on Egg-killing Washes. The ovicidal Properties of Lauryl Rhodanate.**—*Rep. agric. hort. Res. Sta. Bristol 1935* pp. 49–57, 8 refs. Bristol [1936].

Work was carried out to find an ovicide other than tar oil that would be effective against Aphids and *Psylla mali*, Schm., on apple and could be incorporated in the petroleum oil wash commonly used against red spider [*Paratetranychus pilosus*, C. & F.], Capsids and winter moth [*Cheimatobia brumata*, L.] without causing damage to buds, as tar oil does after the true dormant period when petroleum oil is most profitably applied. In view of the findings of D. F. Murphy and C. H. Peet [*R.A.E.*, A **21** 566], thiocyanates (rhodanates) were tested in comparison with tar oil on eggs of *Aphis* (*Anuraphis*) *pomi*, DeG., and in preliminary tests also on those of *Psylla mali*.

In the tests with *Aphis pomi*, shoots bearing the eggs were dipped for 15 seconds in the insecticide in the last week of January, and were then kept with controls under conditions that permitted normal hatching, until this was completed in April. The technique is described in detail.

In the preliminary tests a stock emulsion of 60 per cent. light petroleum oil with 10 per cent. Agral S. R., alone or containing 10 per cent. cetyl rhodanate or 5 per cent. lauryl rhodanate, was made up to the required concentration with water. Almost complete control was obtained with lauryl rhodanate (the thiocyanate of commercial lauryl alcohol of which the predominant constituent is a dodecyl derivative)

at a concentration of 0·4 per cent., while tar oil at 2 per cent. gave a high, but at 1 per cent. a low control. The cetyl rhodanate at 0·8 per cent. was less effective than the 2 per cent. tar oil.

Further trials were carried out in the following season with emulsions containing lauryl rhodanate prepared in different ways, to examine the influence of method of compounding upon efficiency. When not used with oil, the rhodanate was dissolved in oleic acid and emulsified by adding this solution to a dilute solution of sodium hydroxide. The results of analysis of the various oil samples used are given. Lauryl rhodanate alone at 0·2 per cent. gave very good control, it was excellent at 0·4 per cent. in solution with petroleum oil (4·6 per cent.) emulsified with Agral S. R. (being superior to tar oil at 2 per cent.) ; and at 0·4 per cent. in solution with petroleum oil (5 per cent.) emulsified by the two-solution method with oleic acid and sodium hydroxide it destroyed 100 per cent. of the eggs. Petroleum oil alone and cetyl rhodanate gave results very much inferior. The preliminary experiments on eggs of *Psylla mali* revealed high toxicity of combinations of lauryl rhodanate and petroleum oil at concentrations effective against the Aphid. In a preliminary field trial, the combined spray of 0·4 per cent. lauryl rhodanate and 5 per cent. petroleum oil applied on nursery apple trees on 21st February gave a high degree of control of Aphids and caused no injury to the buds or bark.

Kearns (H. G. H.) & Umpleby (E.). **The Control of Woolly Aphid (*Eriosoma lanigerum* Hausm.) on Nursery Trees.**—*Rep. agric. hort. Res. Sta. Bristol 1935* pp. 67–75, 1 pl., 4 refs. Bristol [1936].

In the west of England infestation of nursery cider apple trees by *Eriosoma lanigerum*, Hsm., commonly starts on the root stock and gradually extends upwards. It can cause serious damage to young trees unless the initial attack on the roots and stem is efficiently controlled. During 1933-35, tar oil dipping of young trees for the control of the Aphid [*cf. R.A.E.*, A **19** 607] was tested with special reference to the possibility of injury to the tree, and compared with hot water immersion. In January 1934, 117 two-year-old bush trees, mostly known to be infested, were dipped for at least 5 minutes in 10 per cent. high boiling neutral tar oil emulsion (9 per cent. oil) and 39 trees were used as controls. By September 38·4 per cent. of the control trees and 14·5 per cent. of the treated ones were infested. Soil on the roots should be removed by soaking the trees in water before treating them, as it prevented contact between the Aphids and the oil. The treatment should be followed by stem cleaning in spring. There was no apparent difference in the conditions of growth of the treated and untreated trees [*cf.* **24** 653]. Severely infested bush trees of mixed varieties, completely immersed on 15th March 1935 in hot water at 110°F. for 30 minutes, having previously been washed in running water, were still clean 2 months later. On 12th June one was badly infested and was probably the cause of a 20·5 per cent. infestation (9 trees) in October. All the control trees remained infested throughout the season. The growth on treated trees was more vigorous than on the controls.

Injury to the trees by hand applications of kerosene [*cf.* **22** 663] and the possibility of substituting for them an emulsion spray of nicotine and oil were also examined. In 1932, a sample of atomised kerosene with a specific gravity at 15°C. of 0·788, containing 7 per cent. aromatics and boiling at from 154 to 268°C. did not appreciably injure the foliage.

During June and July 1933, this refined kerosene was applied by hand to colonies of Aphids on the stems of standard cider apple trees of different varieties. The control was satisfactory and a given volume of kerosene treated more trees than the same volume of methylated spirit, but during the following season there was a noticeable increase of canker on the trees. In 1935 the experiment was repeated on 84 trees of various varieties. The treatment scorched green side shoots within 2 weeks, retarded their growth, in some cases killing them completely, and caused large pieces of bark to die away leaving areas particularly susceptible to canker. In January 1936, 90 per cent. of the trees were seriously affected. Methylated spirit caused no injury to older trees, but should not be used on nursery stock, as it scorches the foliage and causes the side shoots to die back. Two applications, on 12th and 22nd July, of a spray containing 1 gal. refined white oil and 8 fl. oz. nicotine to 100 gals. were made to 48 infested trees. Of these, 19 were still infested on 10th August, representing a 60·4 per cent. reduction in infestation. A similar number of control trees showed a reduction of 19 per cent. in infestation.

WALTON (C. L.). **The Control of Flea Beetles by Means of a Seed Dressing. Progress Report.**—*Rep. agric. hort. Res. Sta. Bristol 1935* pp. 80–86, 6 refs. Bristol [1936].

Seed dressings of kerosene or turpentine have been tried, with results that were not completely satisfactory [*R.A.E.*, A **16** 617; **17** 437], to control flea-beetles on crucifers under farm conditions, where sprays and dusts are not economically practicable. Field trials were therefore carried out in the south-west midland district of England in 1933, 1934 and 1935 with a dressing evolved by the author and H. G. H. Kearns. Examination of 25 samples of flea-beetles from swedes and kale showed that *Phyllotreta undulata*, Kutsch., occurred at 17 centres, *Chaetocnema* (*Plectroscelis*) *concinna*, Marsh., at 6, *Phyllotreta atra*, F., at 1, *P. ochripes*, Curt., at 2, and *P. consobrina*, Curt., at 1. *P. cruciferae*, Gze., is abundant on cabbage. The dressing, which has some repellent action, consists of 4 lb. paradichlorobenzene and 1 lb. naphthalene, in the form of crude creosote salts, dissolved in 1 gal. kerosene, a proportion that avoids the formation of crystals of naphthalene, which do not adhere to the seeds. From ½ to 1 fl. oz. of the dressing was used per lb. seed, making the maximum cost of materials 2*d.* per acre. The dressing was applied one day before planting. No injury to the seed was noticed. In 1933, dressing more than doubled the number of plants, and in one centre reduced the attack from 53 to 3 per cent. In 1935, treatment increased the average number of plants per foot from 4·5 to 13·6 and reduced the degree of infestation from 42 to 86 per cent. Drought interfered with the trials in 1934, but the dressing gave some control. The protection was effective in all trials during the germination period and was prolonged in the majority of cases up to the " rough-leaf " stage. Orthodichlorobenzene was not promising.

KEARNS (H. G. H.). **A Note on *Melasoma populi* L. (Chrysomelidae) as a Pest of Basket Willows.**—*Rep. agric. hort. Res. Sta. Bristol 1935* pp. 87–90, 1 pl., 1 ref. Bristol [1936].

An infestation by the large Chrysomelid beetle, *Melasoma populi*, L., which started in 1933 on a willow bed in Somerset, became severe in the

following year, and observations were made in 1935. The adults overwintered beneath a layer of cut stones and, in May 1935, emerged and migrated, apparently by crawling, to a bed of basket willows (*Salix purpurea*). They attacked the young shoots, in some instances consuming the buds so fast that stools were prevented from developing any shoots until all the adults had died after egg-laying. Stools less severely attacked frequently produced rods with numerous side shoots. Adults died soon after oviposition. There were approximately equal numbers of males and females. Eggs were laid principally in May and early June, but some were found up to the third week in July. They were cemented on end to the leaf in irregular batches of 29–51. In captivity females laid an average of 178 eggs, but probably they would lay more under natural conditions. The incubation period was 7–10 days, but all eggs of one batch hatched on the same day. The larvae, which had three instars, fed on the leaves and completed development in 18–20 days. The pupal period occupied 7–12 days and was passed just below the surface of the soil. Adults emerged from the third week in July and fed mainly on the upper portions of the rods, first consuming the leaves and later the peel. There was considerable overlapping of stages under field conditions.

In the second season, infestation became so severe that a quarter acre bed was entirely spoiled and many stools died out in the following winter. Although infestation spread to another bed of *S. purpurea* half a mile away, intervening beds of other willows were left unharmed. A few weeds under the *S. purpurea* were attacked. Laboratory tests showed that the adult is readily killed by a wash containing not less than 0·0025 per cent. crystalline rotenone. The larvae were not so easily killed by a derris wash, but were controlled by lead arsenate. The infested bed was sprayed on 27th June 1934, with a combined wash consisting of derris root, 4 lb. lead arsenate powder and a proprietary wetter in 100 gals. water. Large numbers of the adults were killed by contact action, and many more as well as the larvae died later from lead arsenate poisoning. Several applications of the derris wash in spring as soon as large numbers of the adults appear and an application of the combined spray in mid-June to control the larvae and ovipositing beetles are recommended. The lower surfaces of the leaves must be covered with the arsenate.

MacLagan (D. S.) & Dunn (E.). **The Experimental Analysis of the Growth of an Insect Population.**—*Proc. roy. Soc. Edinb.* **55** (1934–35) no. 2 pp. 126–139, 4 graphs, 3 figs., 9 refs. Edinburgh, 1936.

From experiments in rearing *Calandra* (*Sitophilus*) *oryzae*, L., in wheat at constant favourable temperature and humidity, the authors make an analysis of the factors that constitute the internal resistance of an animal population to further growth. The following is taken from their summary. Internal resistance to further growth is brought about by a lowering of fecundity and fertility and an increase in the mortality of the eggs and young larvae. There is no indication of any "conscious" effort of the weevils to limit the rate of reproduction as the population-density increases; the limitation of numbers results from influences that are primarily thigmotropic and thus operate automatically. The copulation-frequency increases up to a certain density and then decreases according to a definite biological law. In virtue of the internal

resistance, natural populations can exert an automatic check on their numerical increase and thus the organism itself imposes the ultimate limit to its own abundance in the absence of other factors of control.

HARRIS (H. M.), DRAKE (C. J.) & TATE (H. D.). **Observations on the Onion Thrips** (*Thrips tabaci* **Lind.**).—*Iowa St. Coll. J. Sci.* **10** no. 2 pp. 155–172, 3 pls., 4 figs., 70 refs. Ames, Iowa, January 1936.

This is a record of observations in Iowa to obtain information on the rate of population increase of *Thrips tabaci*, Lind., and the effects of temperature and rains on infestations. From 12th June to 2nd July 1928 the adults and larvae were removed from the exposed foliage of 10 onion plants selected at random from the field each day and counted. A graph shows the trend of population, which reached its peak on 24th June with 1,596 individuals. A sudden decline on 26th–27th June was the result of driving rains and a heavy hailstorm. The effect of heavy rains was considerably influenced by the type of soil ; slight rains had little effect on the populations. During heavy downpours many thrips were beaten to the ground and destroyed and, in soils that had a tendency to cake, emergence of newly transformed adults and individuals that had sought refuge in crevices in the soil was considerably checked. The season of 1928 was ideal for the increase of the thrips, but that of 1934 was extremely unfavourable, owing to very high temperatures and prolonged drought. A study of the sex-ratio of the thrips collected during the counts showed that a series of 500 adults represented 452 females and 48 males. Of 240 adults collected in November 1931 only 4 were males. A hundred newly hatched larvae obtained from unmated females produced only winged males, but later one of the authors reared from unmated females a dozen offspring all of which were females [*cf. R.A.E.*, A **18** 680 ; **21** 465]. The length of life of the adult females at a constant temperature of 30°C. [86°F.] ranged from 9 to 39 days with a mean of 19·9 days. Oviposition began 4–6 days after emergence. The duration of the egg stage and the two larval instars depended greatly upon temperature conditions. The prepupal and the pupal stages in the soil lasted 1–3 and 1–4 days, respectively.

TRAVIS (B. V.). **Relative Toxicity of certain Stomach Poisons to** *Phyllophaga lanceolata* (**Say**) (**Coleoptera-Scarabaeidae**).—*Iowa St. Coll. J. Sci.* **10** no. 3 pp. 235–241, 1 fig., 7 refs. Ames, Iowa, April 1936.

ANDRE (F.) & PRATT (P. E.). **The Toxicity of certain Stomach Poisons to the June Beetle,** *Phyllophaga implicita* (**Horn**).—*T.c.* pp. 243–248, 9 refs.

In the first paper are given the results of tests on adult females of *Lachnosterna* (*Phyllophaga*) *lanceolata*, Say, a common crop pest in the south-western United States. The poisons were given by the sandwich method, using leaves of potato. The estimated median lethal doses in mg. per gm. body weight were 0·03 for Paris green, 0·04 for cuprous cyanide, 0·06 for arsenious oxide, and 0·12 for acid lead arsenate. Zinc arsenite apparently had a relatively high toxic value, but the median lethal dose was not ascertained.

In the tests described in the second paper, poisoned sandwiches of elm leaves were fed to adults of both sexes of *L.* (*P.*)

implicita, Horn, a pest of shade and forest trees in Iowa. A wide variation was noted between the amounts of poison required to kill the two sexes, males in every instance being killed more easily . Paris green proved to be the most toxic to females, whereas Paris green and cuprous cyanide were equally toxic to males. Sodium fluosilicate was least toxic to both males and females. Females ate the poisons a little more readily than did the males in every instance. The order in which the beetles ate the insecticides most readily was sodium fluosilicate, sodium fluoride, acid lead arsenate, cuprous cyanide and Paris green.

GLOVER (L. H.) & RICHARDSON (C. H.). **The Penetration of Gaseous Pyridine, Piperidine and Nicotine into the Body of the American Cockroach, *Periplaneta americana* L.**—*Iowa St. Coll. J. Sci.* **10** no. 3 pp. 249–260, 6 graphs, 32 refs. Ames, Iowa, April 1936.

A preliminary account of this investigation has already been noticed [*R.A.E.*, A **22** 498]. This more detailed report presents a part of the results that have been obtained to date using adults and a few late-instar nymphs of *Periplaneta americana*, L. The following is taken from the authors' summary: The cockroaches were treated with pyridine, piperidine and nicotine in the gaseous state. Entire insects, parts and tissues were extracted, and the compounds were detected and their concentrations determined in the extracts. The approximate concentrations, in mg. per gm. body weight, in the cockroaches when 50 per cent. were dead and (in brackets) the times in minutes for 50 per cent. mortality were 2·9 (51) for pyridine, 1·0 (12·5) for piperidine, and 1·2 (860) for nicotine. The compounds appeared to enter the body largely through the cuticula. The ventral nerve cord did not take up so much nicotine as the cuticula and no more than the large muscles, fat-body and the tissues of the digestive tract. It accumulated as much pyridine and piperidine as the cuticula. The muscles took up a very small amount of the former and a relatively large amount of the latter. The digestive tract tissues and the fat-body showed less pyridine and piperidine than the cuticula.

RUSSO (G.). **Contributo alla conoscenza degli insetti della Repubblica Dominicana (Antille). Nota su alcuni Tisanotteri.** [A Contribution to the Knowledge of the Insects of the Republic of Santo Domingo. A Note on some Thysanoptera.]—*Mem. Soc. ent. Ital.* **15** pp. 42–54, 4 figs., 17 refs. Genoa, 15th June 1936.

Thysanoptera observed by the author in Santo Domingo in 1926–29 included *Frankliniella insularis*, Frankl., in the flowers of rose, dahlia, etc. ; two other species of *Frankliniella* on cotton, one of which, possibly *F. helianthi*, Moult., also occurred on beans and sunflower ; *Heliothrips haemorrhoidalis*, Bch., which was common on cacao and also infested *Citrus*, mango, avocado, etc. ; *Dinurothrips hookeri*, Hood, on sweet potato, tomato, etc. ; *Trybomia* sp. on sweet potato ; *Sericothrips* sp. on beans ; and *Haplothrips gowdeyi*, Frankl., in the flowers of cotton and on some wild plants. *Thrips tabaci*, Lind., was widespread and very injurious to onion in the dry season ; it appeared to facilitate the diffusion of a leaf spot disease. Good results against it were obtained by spraying the young plants with nicotine or 3 per cent. lime-sulphur, or by dusting with a mixture of sulphur and tobacco dust. This species

was also noticed on tobacco, beans, etc. At Moca the life-cycle took 15–16 days in spring and summer. Natural enemies included *Ceratomegilla* (*Megilla*) *maculata*, DeG., and a Syrphid larva.

Considerable attention was devoted to *Selenothrips rubrocinctus*, Giard, on account of its importance as a pest of cacao. All stages are described. It was observed on cacao, mango, avocado, *Anarcardium occidentale*, *Terminalia catappa* and *Inga vera*. It continued to breed throughout the year, the life-cycle being completed in 15–20 days. It was sometimes attacked by *Franklinothrips vespiformis*, Crwf., which was observed on cacao, mango, etc., and by the fungus, *Beauveria globulifera*. A nicotine spray was found of value for control, but the greatest importance is attached to the provision of shade [*R.A.E.*, A **19** 117].

da Costa Lima (A.). **Dois novos insectos de** *Xanthium*.—*Ann. Acad. bras. Sci.* **8** no. 2 pp. 157–161, 2 pls., 2 figs. Rio de Janeiro, 1936.

In the course of work on insects that might be introduced into Australia for the biological control of *Xanthium pungens* (Noogoora burr), R. C. Mundell collected puparia from heads of *X. cavanillesii* in São Paulo. From these were reared a new Trypetid and a new Pteromalid parasite of it, which are here described as *Tephritis mundelli* and *Habrocytus tephritidis*.

Pal (B. P.). **A Note on the Relation between the internal Stem Structure of certain Varieties of Gram** (*Cicer arietinum* **L.) and their Resistance to Cutworm Attack.**—*Proc. Indian Acad. Sci.* **3** no. 6 pp. 527–534, 3 pls., 3 refs. Bangalore, June 1936.

Observations at Pusa showed that varieties of *Cicer arietinum* that were very slightly attacked by cutworms were characterised by a large stem diameter and extensive development of woody tissues, whereas severely attacked varieties had a comparatively small stem diameter and the secondary wood was weakly developed.

Fotidar (M. R.) & Raina (J. L.). **San Jose Scale in Kashmir and its Control.**—8 pp., 2 pls. Karachi [1936].

A brief account is given of the bionomics and control of *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., in Kashmir, where it occurs on most kinds of deciduous plants, and is particularly common on *Cydonia japonica*, apple and peach. The overwintered nymphs become active in mid-March, and the males have emerged by mid-April. The females began to reproduce in mid-May and gave rise to 200–400 nymphs in a month. These crawlers settle after 1 day, and 2 days later start to secrete a waxy covering, which is completed in about 4 days. The nymphs moult about 12 days after settling, and mature in 20 days. The life-cycle occupies 35–40 days, and 4 or 5 generations are completed before mid-October, when hibernation begins. Natural enemies of the scale include Coccinellids and a parasite of the genus *Aspidiotiphagus*, but these do not check its increase. The spray found most satisfactory for its control consists of a stock emulsion of 1½ gals. Diesel oil, 1 lb. fish-oil soap and 1½ gals. water, diluted at the rate of 1 : 7. If the water

is extremely hard, Bordeaux mixture (1 : 1 : 50) should be used as an additional emulsifier. Spraying should be started when the leaves fall and continued until the buds begin to shoot (generally in April). Sprays containing stock emulsion at a dilution of 1 : 24 may be applied in the summer to prevent the fruit becoming infested. It is concluded from a discussion of costs that spraying is justified.

YANG (We-I.). **Notes on the Chinese Tessaratominae with Description of an exotic Species.**—*Bull. Fan mem. Inst. Biol.* **6** no. 3 pp. 103–144, 5 pls., 2 figs., 34 refs. Peiping, 20th March 1935. (With a Summary in Chinese.) [Recd. August 1936.]

This revision of the TESSARATOMINAE of China includes descriptions of one new genus, three new species and a new variety. These Pentatomids are stated to be very injurious to cultivated plants, a notable example being *Tessaratoma papillosa*, Drury, which damages litchee [*Litchi chinensis*], causing an annual loss in Kwangtung estimated at about 2,000,000 Chinese dollars.

MORI (N.). **On *Cassida nebulosa* L.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 1–3. Tokyo, March 1936.

Descriptions are given of all stages of *Cassida nebulosa*, L., which feeds on *Chenopodium* and sugar-beet in Japan.

YOSHINO (S.) & HARADA (T.). **Experiments with Heat-killing of *Bruchus*.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 8–9. Tokyo, March 1936.

In test tubes without food, adults of *Bruchus chinensis*, L., were killed by exposure to 50°C. [122°F.] for 5 minutes, and those of *B. rufimanus*, Boh., by exposure to 55°C. [131°F.] for 20 minutes. Adults of the latter Bruchid in beans were not killed by exposure to 50°C. for 2 hours.

YAMAZAKI (T.) & SATO (T.). **Studies on *Bruchus quadrimaculatus* Fab.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 19–35, 1 fig. Tokyo, March 1936.

In 1930, eggs of *Bruchus quadrimaculatus*, F., were found in Kobe in beans imported from India, and studies were made on its life-history. There were 5 broods a year, the larvae hibernating from October to May. The adults lived for 4–13 days, and laid an average of 93·7 eggs in 8·5 days. The egg stage lasted 4–8 days, and 94 per cent. of the eggs hatched. The larval stage, including 4 instars, lasted 10 days in August. The larva consumed an average of 24·4 mg. of bean during its development. The pupal stage lasted 3–6 days. The eggs and larvae were more difficult to kill with hydrocyanic acid gas than the adults.

TANAKA (K.). **On *Zeugodacus bezzii* Miyake.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 42–46, 3 figs. Tokyo, March 1936.

Notes are given on the life-history of *Dacus scutellatus*, Hend. (*Zeugodacus bezzii*, Miyake), which infests *Trichosanthes cucumeroides* in Japan.

MURAKAMI (S.). **Observations on Chrysomelidae.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 46–54, 1 fig. Tokyo, March 1936.

Notes are given on the morphology and biology of *Galerucella* (*Pyrrhalta*) *annulicornis*, Baly, on *Viburnum*, *Lema decempunctata*, Gebl., on *Lycium chinense*, *Plagiodera versicolora*, Laich., on willow (*Salix*), and *Morphosphaera japonica*, Hornstedt, on *Ficus* spp., including cultivated figs. The adults of *M. japonica*, which has one generation a year, begin to appear in late March and oviposit in mid-April. The egg, larval and pupal stages last 3–7 days, about a month, and 2–3 weeks, respectively. The larvae, which are gregarious, secrete an adhesive substance and can be killed by dusting dry soil or ash over them.

IBA (F.). **On** *Erthesina fullo* **Thunberg, especially the Colour Variation of the Nymphs.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 54–59, 1 fig. Tokyo, March 1936.

Brief notes are given on the Pentatomid, *Erthesina fullo*, Thnb., which feeds on cherry and other trees in Japan.

NODA (S.). **On** *Notolophus posticus* **Wlk.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 106 pp. 64–67. Tokyo, March 1936.

In the Loochoo Islands, *Notolophus posticus*, Wlk., feeds on soy beans, mulberry, and a variety of other plants. The egg stage lasts 4–8 days, the larval 15–22, and the pupal 4. All stages are described.

SHIBUYA (M.). **Percentage of Parasitisation of** *Trichogramma japonica* **Ashm. in the Second Emergence Period of the Moths of** *Chilo simplex* **Butl.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 1–5, 6 figs. Tokyo, March 1936.

In September 1934, about 58 per cent. of the egg masses of *Chilo simplex*, Btlr., on a crop of rice in Shizuoka were parasitised by *Trichogramma japonicum*, Ashm. When the new egg batches were deposited, 33·3 and 61·3 per cent. of the egg masses, and 6 and 15·5 per cent. of the individual eggs, were attacked in 2 and 4 days respectively. There was no relation between the height of the egg masses from the ground and the percentage of parasitism, but the percentage was higher near light-traps, where the egg masses were more abundant.

KONO (Y.). **Kerosene Lamps as Light Traps for** *Chilo simplex* **Butl.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 6–11. Tokyo, March 1936.

Tests were made of various types of light-traps sold in Japan for adults of *Chilo simplex*, Btlr. They were most effective at a height of 3 ft. above the ground during the first emergence period of the moths and at 5 ft. during the second. With lamps of 10 candle power over dishes of water, about 10 traps are required per acre.

HISADA (K.). **On the Autumn Injuries of** *Chilo simplex* **Butl. considered from the Standpoint of the Egg Parasites at the first Emergence Period of the Moths.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 12–20. Tokyo, March 1936.

It is possible in Kyoto to predict whether damage to rice by *Chilo simplex*, Btlr., will be serious in the autumn by observing the percentage of parasitism by egg parasites at the end of June. In 1921,

1923 and 1924, the percentage was lower than 40, with the result that the autumn damage was serious. In 1922 the percentage was over 40 and the damage slight. If the percentage of the rice stalks injured by the borer in autumn is 10, significant damage occurs, and if it is over 20 the result is serious. Spraying with nicotine sulphate is effective against the eggs in the spring, and does not affect the parasites in them. Spraying is most effective at the peak of emergence of the moths.

MATSUMOTO (S.). **On the Life-history of** *Chlorops oryzae* **Matsumura, especially on its Hibernation.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 29–36. Tokyo, March 1936.

Chlorops oryzae, Mats., has 3 generations a year in the Okayama Prefecture, the adults emerging in May, July and October. The first generation eggs are laid on rice seedlings and the larvae feed on the unfolded leaves, but those of later generations infest the young ears, sometimes reducing the crop by 10–20 per cent. Grasses such as *Alopecurus*, *Festuca*, etc., are also attacked and the larvae of the last generation hibernate in the stalks of these, pupating early in May.

SAWA (R.). **Experiments with Fumigating and Poisoning the Larvae of** *Anomala rufocuprea* **Motsch.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 37–62. Tokyo, March 1936.

The adults of *Anomala rufocuprea*, Motsch., cause serious damage to soy beans in the Ibaragi Prefecture, Japan, and the larvae infest the roots of vegetables or rice not cultivated under water. In experiments the larvae were bred in wet soil containing various percentages of insecticides, of which lead arsenate was very effective. All first-instar larvae were killed in about 4 days in soil containing 0·4 per cent. lead arsenate or in about a month in soil containing 0·04–0·08 per cent. The older larvae were more resistant, but in the third instar all were killed in 22 days in soil containing 0·8 per cent. The younger larvae of *A. rufocuprea* were also less resistant to fumigants. Chloropicrin was about 15 times as effective as carbon bisulphide against the first-instar larvae and about 5 times as effective against the third. Hydrocyanic acid gas was as effective as chloropicrin in the upper part of the soil, but much less so at a deeper level. The eggs were more resistant to fumigants than the larvae. Rice plants were not injured by soil injections of 20 cc. carbon bisulphide 4 ins. away from them or of 2 cc. chloropicrin 6 ins. away.

MAIDA (A.). **On the Fumigation of** *Bruchus rufimanus*. [*In Japanese.*] —*Nojikairyo-shiryo* no. 109 pp. 63–65. Tokyo, March 1936.

In Japan, broad beans are fumigated with chloropicrin for the control of *Bruchus rufimanus*, Boh., but it has been found that the percentage of germination may be reduced if the fumigant is used at the rate of 8 oz. per 1,000 cu. ft. for 72 hours.

SAITO (H.). **On** *Rhizoecus kondonis* **Kuwana, a Pest of** *Citrus*. [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 72–74. Tokyo, March 1936.

Descriptions are given of both sexes of *Rhizoecus kondonis*, Kuw., which infests the roots of *Citrus* in Kagoshima Prefecture.

Sawaragi (M.). **On the Control Methods of the Larvae of** *Rhaphidopalpa femoralis* **Motsch.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 119–128. Tokyo, March 1936.

The eggs of *Rhaphidopalpa femoralis*, Motsch., are laid at the base of the stalks of cucurbits, and the larvae attack the roots, 90 per cent. occurring within 5 ins. of the soil surface. Sulphur dusted on the soil round the stalks is a very effective repellent, but it retards the development of the stalks and leaves. Sprays containing derris are recommended for control, nicotine sulphate being rather less effective. In the Mie Prefecture they should be applied twice, in mid-June and early July.

Okamoto (G.). **On** *Phyllotreta vittata* **Fab.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 129–131. Tokyo, March 1936.

Phyllotreta vittata, F., all stages of which are described, is very common on cruciferous vegetables in Japan. The adults appear in late February, and breeding continues from early March until mid-November. The female lays about 200 eggs. The egg, larval, prepupal and pupal stages average 9, 16, 2–3, and 9–10 days, respectively, but the duration of the complete life-cycle varies from 16 days to 8 weeks, according to the time of year. The adults feed on the leaves of the plants, and the larvae on the roots ; the damage is most severe during June–September. A derris insecticide and kerosene emulsions are very effective for control.

Katsumata (K.). **Results of Observations on** *Scepticus tigrinus* **Roelf.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 133–148. Tokyo, March 1936.

Descriptions are given of all stages of *Scepticus tigrinus*, Roel., the adults of which attack the leaves and buds of watermelon, strawberry, *Arctium lappa*, peas, apple, cherry, plum, persimmon and other plants growing in sandy soil in Ishikawa Prefecture. This weevil has one generation a year. After hibernation, the adults appear in late April or May and begin to oviposit 4 or 5 days later. They usually remain in the soil and oviposit there by day, and crawl up the plants to feed at night. The oviposition period lasts about 40 days, and the number of eggs laid by a female averages 164·2. The larvae hatch after 7–23 days and feed superficially on roots, usually occurring in dry soil. The larval stage lasts about 2 months (on roots of *Arctium lappa*), including a prepupal period of a fortnight, and the pupal stage some 20 days. The adults emerge in August, September and October. A spray of lead arsenate (8 lb. in 100 gals. water) only killed 30 per cent. of the adults, but nicotine sulphate (1 : 400) killed 87·5 per cent. of the eggs. The weevils cannot fly and so can be prevented from reaching the plants by barriers of boards with a strip of zinc bent over at the top.

Yashiro (H.). **Outline of the Work of establishing** *Opius fletcheri* **Silv. in Ishigaki Island, Loochoo.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 149–152. Tokyo, March 1936.

Dacus (*Chaetodacus*) *cucurbitae*, Coq., is a serious pest of cucurbits in Ishigaki (Loochoo Islands), but injury by it has been much reduced as a result of the establishment of *Opius fletcheri*, Silv., from Formosa in 1932–34.

Sakai (K.). **On the Control of** *Ischnodemus saccharivora* **Okaj. in an infested Area.** [*In Japanese.*]—*Nojikairyo-shiryo* no. 109 pp. 153–156. Tokyo, March 1936.

Ischnodemus saccharivorus, Okaj., was imported into a district of Kagoshima Prefecture (Kyushu) from the Loochoo Islands in 1928, and has since caused serious damage to sugar-cane. It has 3 generations a year, hibernating in the adult stage. Nicotine sulphate (1 : 1,500) in soap solution was found to kill over 97 per cent. of the nymphs, and this spray was applied over the whole infested area at one time with successful results.

Harukawa (C.) & Kumashiro (S.). **On** *Sitotroga cerealella* **Oliv. 1.** [*In Japanese.*]—*Nogakukenkyu* **26** pp. 426–448. Kurashiki, June 1936.

Sitotroga cerealella, Ol., which is widely distributed in Japan, has 4 or 5 generations a year in the neighbourhood of Kurashiki. It passes the winter in the larval or occasionally the pupal stage. The hibernating larvae begin to pupate early in April. The adults of the successive generations usually emerge in May, July, early and late August, and October, though some of the larvae begin to hibernate in August. In experiments, the duration of the life-cycle was 60 days at an average temperature of 16·2°C. [61·1°F.], 32 at 20°C. [68°F.], and 23 at 28°C. [82·4°F.]. The optimum temperatures for oviposition were 20-30°C. [68–86°F.], and no eggs were laid at constant temperatures of 10°C. [50°F.] or 36°C. [96·8°F.], though a few eggs are produced in houses at an average temperature of 7°C. [44·6°F.]. The percentages hatching were over 66 at 36°C., over 77 at 34°C. [93·2°F.], and 10–12 at 12°C. [53·6°F.]. Hatching did not occur at 10°C. The larvae grew very little at 34°C. or 12°C., and did not survive at 10°C. The females lived 18–19 and 28–29 days at average temperatures of 15°C. [59°F.] and 12·6°C. [54·6°F.].

Harukawa (C.) & Kumashiro (S.). **On** *Tipula aino* **Alex. 1.** [*In Japanese.*]—*Nogakukenkyu* **26** pp. 449–490. Kurashiki, June 1936.

Tipula aino, Alexander, a pest of rice in Japan, has 2 generations a year, hibernating in the larval stage. Pupation begins in February or more usually March, when the average temperature reaches 5 or 6°C. [41 or 42·8°F.], but chiefly occurs during April, when the temperature is about 11 or 12°C. [51·8 or 53·6°F.]. Some adults emerge in late March at 10°C. [50°F.], but most of them do so in April at 14–15°C. [57·2–59°F.]. Those of the next generation appear between the end of August and the beginning of October. The duration of the egg stage is 13 days at 13–14°C. [55·4–57·2°F.], 10 at 15–16°C. [59–60·8°F.] and 4 at 24–25°C. [75·2–77°F.]. The larval stage lasts 96 days at 25°C. and 143 days at 22·6°C. [72·7°F.], and larvae that hibernate mature in 219 days at 9·4°C. [48·92°F.]. They apparently continue to grow at or even below 5°C., but the optimum temperature is 24–25°C. The pupal stage lasts 21 days at 9°C. [48·2°F.], 9 at 18·5°C. [65·3°F.] and 4 at 26°C. [78·8°F.]

KUMASHIRO (S.). **Observations on the Victims of** *Lanius bucephalus* **Temm. and Schlegel.** [*In Japanese.*]—*Nogakukenkyu* **26** pp. 491–507. Kurashiki, June 1936.

Observations in Japan on the prey of the shrike, *Lanius bucephalus*, which it fixes on twigs, etc., showed that over 47·44 per cent. were insects of which 94·95 per cent. were injurious.

EGUTI (M.). **Phototropism of** *Gelechia gossypiella* **Saund. for purple-coloured and uncoloured Light Traps.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Korea* **8** no. 2–3 pp. 150–156. Suigen, Korea, 1936.

Of 1,502 adults of *Platyedra* (*Gelechia*) *gossypiella*, Saund., caught in light-traps in Korea in 1934 and 1935, 55·9 per cent. were attracted by purple lights and 44·1 per cent. by ordinary ones. The males far outnumbered the females in either collection. Most of the moths were caught in June, August and September, between midnight and 4 a.m.

EGUTI (M.). **The Lethal Point of** *Gelechia gossypiella* **Saund. at high Temperatures.** [*In Japanese.*]—*Ann. agric. exp. Sta. Korea* **8** no. 2–3 pp. 157–161. Suigen, Korea, 1936.

Larvae of *Platyedra* (*Gelechia*) *gossypiella*, Saund., were kept at high temperatures for various periods, and the following percentages of mortality were obtained: 81 in 2 hours and 100 in 3 hours at 50°C. [122°F.]; 97 in 30 minutes and 100 in 40 minutes at 55°C. [131°F.]; and 46 in 10 minutes and 100 in 20 minutes at 60°C. [140°F.].

ISHIDA (M.) & TAKANO (S.). **Relation of the Prevalence of Oviposition of Sugar-Cane Borers to climatic Conditions and the Period of Planting the Cane.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **14** no. 4 pp. 129–170. Taichu, Formosa, April 1936.

In experiments in southern Formosa from 1915 to 1926, 50 young sugar-cane plants were planted each month, and the eggs of moth-borers found on the leaves were counted every week. Those of *Eucosma schistaceana*, Sn., were most abundant in May and December, and least abundant in February and August, probably owing to low temperature (16·3°C. [61·34°F.]) in the former month, and high precipitation (17·9 ins.) in the latter. The number of eggs of *Chilo infuscatellus*, Sn., increased from April to October, but decreased during the following months, owing to low temperatures. Only larvae of *Diatraea venosata*, Wlk., were found between December and February. Oviposition of this species began in March, and the eggs were most abundant in April. They were more numerous in September and October than in August, probably because of high temperatures (27·1–27·4°C. [80·78–81·32°F.]) during July and August.

TAKANO (S.) & IJIMA (K.). **On the Course of Importation into Formosa of** *Bufo marinus* **L.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 124–129, 1 fig. Tokyo, July 1936.

In September 1935, *Bufo marinus* was imported into Formosa from Hawaii for use against sugar-cane pests, but did not become established. In the southern part of the Island it did not hibernate. It fed on

various insects, including pupae of silkworms [*Bombyx mori*, L.], and also on *Bufo melanostictus*, an indigenous toad. Oviposition took place in March 1936.

Ijima (K.). **On *Diatraea auricilia* Dudgeon, an unrecorded Rice Pest in Formosa.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 131–132. Tokyo, July 1936.

Diatraea auricilia, Dudg., was first observed infesting rice in southern Formosa in 1933. In experiments the larvae also fed on sugar-cane. There were 4 generations in a year, and the winter was passed in the full-grown larval stage, the moths emerging from March onwards. Some of the larvae that hatched in September and all those that hatched in November entered hibernation.

Harukawa (C.) & Kumashiro (S.). **Influence of Environmental Factors on the Propagation of *Tipula aino* Alex.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 132–133. Tokyo, July 1936.

Studies of the effect of the environment on *Tipula aino*, Alexander, in rice-fields in Japan showed that the eggs do not normally hatch in soil that contains 35 per cent. water, and 65 per cent. is not sufficient for normal development of the larvae. The optimum temperature and soil moisture for the development of the first generation is 20°C. [68°F.], and 80 per cent. Under these conditions the number of adults produced is 33 per cent. of the initial number of eggs.

Ishii (T.) & Yatomi (K.). **On the Percentage of Parasitisation of *Trichogramma japonica* Ashm. in a Seedling Bed of Rice.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 136–138. Tokyo, July 1936.

The egg-parasite, *Trichogramma japonicum*, Ashm., is the most important natural enemy of *Chilo simplex*, Btlr., in Japan. In a field of rice seedlings in 1935, parasitism first occurred in mid-June [*cf. R.A.E.*, A **23** 515], and the percentage of individual eggs parasitised gradually increased to over 80 in mid-July. About 75 per cent. of the parasites were females throughout this period.

Misaka (K.). **Studies on the Fumigation of the Formosan Fruit-flies. I. A Peculiarity in the Fumigation of the Eggs with Carbon Bisulphide. Preliminary Report.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 140–142. Tokyo, July 1936.

In an experiment carried out in Taihoku, newly laid eggs of *Dacus* (*Chaetodacus*) *dorsalis*, Hend., and *D.* (*C.*) *cucurbitae*, Coq., were fumigated with carbon bisulphide at a temperature of 23–24°C. [73·4–75·4°F.] for 24 hours. The quantities of fumigant are expressed in mg. per litre [equivalent to oz. per 1,000 cu. ft.]. In general, the rate of mortality increased with the concentration of fumigant, 8 and 5·5 mg. giving 100 per cent. mortality of eggs of *dorsalis* and *cucurbitae*, respectively. An exception, however, occurred when the concentration of fumigant was 2 mg. in the case of *dorsalis* or 3 mg. in that of *cucurbitae*, the rate of mortality dropping unexpectedly. The drop was more marked at lower temperatures. The eggs of these flies normally hatch in 24–28 hours at 23–24°C. and their susceptibility to

fumigation increases as their development proceeds. Carbon bisulphide retards embryonic development, and the decrease in its effectiveness at certain concentrations was probably due to the eggs not having developed sufficiently to be at the least resistant stage during the period of exposure.

ONOE (T.). **Influence of Temperatures on Fumigation. I.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 p. 143. Tokyo, July 1936.

The results are given of experiments showing the minimum concentrations of chloropicrin, hydrocyanic acid gas and carbon bisulphide required to kill *Calandra oryzae*, L., in 1, 3 and 6 hours at 13°C. [55·4°F.] and at 3°C. [37·4°F.]. In each case the concentrations are higher at the lower temperature.

SHINJI (O.). **On the Aphids of Cotton at Moppo, Korea, especially an unrecorded and a new Species.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 147–150. Tokyo, July 1936.

Aphis gossypii, Glov., *Myzus persicae*, Sulz., *Macrosiphum* (*Acyrthosiphon*) *gossypicola*, sp. n., which is described, and *Trifidaphis phaseoli*, Pass., are recorded from cotton in Korea.

YUASA (H.). **Cecidomyiids injuring Wheat Ears.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 150–154. Tokyo, July 1936.

Sitodiplosis mosellana, Géh., and *Contarinia tritici*, Kby., have caused serious damage to wheat in Tochigi Prefecture, Japan, *S. mosellana* being much the more abundant. The adults emerge in the second half of May and early June, and are chiefly active during the afternoon, ovipositing in the ears of the wheat. The larvae hatch in about a week and attack the grains, 1–8 being found on each. When full-fed, they spin cocoons in the ground, where they pass the winter. Various grasses are also infested. Sprays containing nicotine sulphate or derris are effective for the control of the adults.

YUASA (H.). **A Cecidomyiid of which an Outbreak occurred in Iwate Prefecture in 1935.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 154–158, 1 fig. Tokyo, July 1936.

A Cecidomyiid that infests the stalks of soy beans in the north of Japan caused serious injury in Iwate Prefecture in 1935, when it reduced the crop by about 39 per cent. It is most prevalent in mountainous areas, in places shaded by trees and in densely planted fields. Hairless varieties of soy bean are less severely attacked.

KISHIDA (K.) & MORINO (I.). *Rhizoglyphus echinopus* **Fum. and Robin injuring** *Allium bakeri*. [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 174–175. Tokyo, July 1936.

Brief notes are given on the morphology of *Rhizoglyphus echinopus*, F. & R., which, in recent years, has caused serious damage to subterranean parts of *Allium bakeri* in Fukui Prefecture. The plants were stunted and discoloured, and in some cases about 50 per cent. of the crop was lost.

HIROSE (K.). **Insect Pests of Insect Specimens and Control Methods.** [*In Japanese.*]—*Insect World* **40** pp. 248–251. Gifu, Japan, July 1936.

Brief notes are given on the Dermestids, *Anthrenus verbasci*, L., *Attagenus japonicus*, Reitt., and *Dermestes coarctatus*, Harold, which attack dried insect specimens.

[KRAĬTER (A. D.).] **Крайтер (А. Д.). Comparative Toxicity of Soaps in Connection with their chemical Composition and some physical and chemical Properties.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 14–27, 7 refs. Leningrad, 1935. (With a Summary in English.) [Recd. 1936.]

An account is given of laboratory experiments carried out in 1933 in Russia on the toxicity to insects of various liquid soaps. The acidity of the fatty acids extracted from vegetable oils, dolphin blubber, colophony and naphthene was determined, and neutral sodium, potassium and ammonium soaps were prepared from them. Alkaloid "soaps" were also prepared by substituting nicotine and anabasine for the alkali. The tests were made on adults of *Brevicoryne brassicae*, L., and a temperature of 21–24°C. [69·8–75·2°F.] was maintained. In each experiment 50 Aphids placed in a Petri dish lined with flannel were sprayed with 1 cc. of the tested solution. Control Aphids were sprayed with distilled water. The insects were then transferred to glass tumblers with fresh cabbage leaves at the bottom and the percentage mortality after 48 hours was calculated. The results are shown in tables.

It was found that the sodium soaps were more toxic in all concentrations than the potassium soaps, and the ammonium soaps were the least effective. Of all the alkali soaps tested, those made of the dolphin blubber acid, characterised by a high content of volatile and highly molecular non-limited acids, were the most toxic, 100 per cent. mortality being obtained with sodium solutions containing 1 or 0·75 per cent. of the fatty acids. They were followed in descending order of toxicity by soaps made from acids of linseed oil (of which up to 80 per cent. are non-limited), cotton-seed oil (of which about 25 per cent. are saturated highly molecular acids), coconut oil, naphthene, colophony and castor oil.

The alkaloid soaps were much more toxic than the alkali soaps, 100 per cent. mortality being obtained in all cases with soaps containing 0·25 per cent. of any of the fatty acids and 0·14 per cent. of the alkaloid. At low concentrations the anabasine soaps were more effective than the corresponding nicotine soaps, probably because the latter are transformed into the molecular dispersal condition and lose their colloidal properties sooner. Solutions of pure nicotine and anabasine and of their sulphates were considerably less toxic than the soaps with the same content of the alkaloid in the solutions.

The magnitude of, and change in, the surface tension of the soap solutions at various concentrations and their viscosity did not correlate with the changes in toxicity. The hydrolysis of the soap solutions in the usual concentrations and at ordinary summer temperatures was very feeble. The author does not agree with the view that the toxic effect of soaps is due to the products of hydrolysis, especially to the liberation of free fatty acids [*R.A.E.*, A **15** 650, etc.]; he believes that the most toxic solutions are obtained with soaps that hydrolyse

the least ; thus, the colophony acid soaps, which hydrolysed more than the others, were the least toxic. The effectiveness of the soap solutions depends on the degree of the solubility of the soaps in the water, the character of the wetting of the chitin of the insects and the depth of the penetration of the solution into the respiratory system. The solutions of the sodium soaps were clear, whereas those of the ammonium and almost all the potassium soaps were turbid.

[Aristov (M. T.) & Vodinskaya (K. I.).] **Аристов (М. Т.) и Водинская (К. И.). The Strawberry Mite (*Tarsonemus fragariae* Zimm.) and its Control.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 28–43, 5 figs., 44 refs. Leningrad, 1935. (With a Summary in English.) [Recd. 1936.]

Tarsonemus pallidus, Banks (*fragariae*, Zimm.), all stages of which are described, is a serious pest of strawberries in various parts of European Russia. In the Department of Leningrad, where observations were carried out in 1934 and 1935, infestation reduced the crop by about 40 per cent., lowered the production of runners for planting, and rendered necessary the premature renewal of plantations. The susceptibility of different varieties of strawberry is briefly discussed, and an account of the bionomics of the mite is given, largely based on the literature [*R.A.E.*, A **17** 126 ; **21** 371 ; etc.], together with notes on its seasonal occurrence in the Leningrad Department. In experiments on the sterilisation of infested plants with hot water [*cf.* **21** 371, etc.], all mites in all stages were killed by immersion for 5 minutes at 45°C. [113°F.]. Only 9 per cent. of the plants were killed by the treatment ; the others recovered in 10–15 days and were in a healthy condition afterwards. The standard varieties of strawberry withstood immersion for 10 minutes.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Experimental Investigations of the Influence of Temperature on the Development of the Sugar Beet Web Worm (*Loxostege sticticalis*).** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 44–63, 18 refs. Leningrad, 1935. (With a Summary in English.). [Recd. 1936.]

To determine the optimum temperatures for development of *Loxostege sticticalis*, L., laboratory experiments were carried out in Russia in 1934 in which the larvae were kept individually in test tubes at a relative humidity of 90–100 per cent. and fed on *Chenopodium album*, and the moths were fed on sugar solution and allowed to pair in glass tumblers and oviposit in test tubes. The experiments comprised three series, in the first of which the insects were subjected to different constant temperatures during their whole life-cycle, in the second only during the larval and the prepupal stages, and in the third only during the pupal stage, all other stages being kept at 25–26°C. [77–78·8°F.]. It was found that the thresholds of development and the sums of effective temperatures necessary to complete development differed in the different stages. The optimum for the eggs was 28°C. [82·4°F.], the threshold 11·2°C. [52·16°F.], and the temperature sum 35 day-degrees C. [63 F.]. In the case of the larvae, the optimum was 25°C. during the first instar and 32·7°C. [90·86°F.] during the other four, the threshold of development was 9·8°C. [49·64°F.] and the temperature sum 156·6 day-degrees C. [281·88 F.]. For the prepupal stage the corresponding figures were 32·7°, 17·3° and 30 day-degrees C. [90·86, 63·14 and 54 F.],

and for the pupal stage 28·1°, 12·4° and 121·2 day-degrees C. [82·58, 54·32 and 218·16 F.].

Investigations on rate of mortality of the larvae showed that those of the first instar were the most susceptible to the influence of temperature, the lowest mortality occurring at 23·3–28·9°C. [73·94–84·02°F.]. In subsequent instars all the larvae survived at 32·7°C. The second and third instars proved to be the most adaptable and developed more rapidly at low temperatures than any other instar.

Observations on oviposition showed that temperatures unfavourable to the immature stages only affected the fertility of the surviving females if the pupae had been exposed to them. The maximum average number of eggs (299 per female) was laid when pupae had developed at 28·1°C. Females that had been reared throughout their development at a constant temperature, however, did not show maximum fertility, indicating that different temperatures are required by successive stages. Thus the abundance of a given generation is limited by conditions affecting the eggs and first-instar larvae, which are the stages most susceptible to temperature, and that of the next generation by conditions affecting the pupae. Furthermore, the susceptibility of this Noctuid to temperature influences explains the sudden fluctuations that occur in its abundance [*cf. R.A.E.*, A **23** 753].

[Lisitzina (L. I.).] **Лисицына (Л. И.).** *Stenocarus fuliginosus* **Mrsh. and** *Ceuthorrhynchus macula alba* **Hbst. as Pests of the Poppy.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 64–72. Leningrad, 1935. [Recd. 1936.]

In the Russian Union the weevils, *Stenocarus fuliginosus*, Mshl., and *Ceuthorrhynchus macula-alba*, Hbst., cause severe damage to poppies, which are an important crop. Observations on them were therefore carried out in 1933 and 1934 in the Department of Voronezh. Both had one generation a year and hibernated in the adult stage. The overwintered adults of *S. fuliginosus* appeared at the end of April and fed voraciously on the young leaves, causing as much damage as the larvae did later. Eggs were laid under the cuticle of the leaves and stems, and the larvae migrated to the roots, on which they fed, often causing the tissue to swell. The infested plants continued to develop until flowering or even maturing, but were easily broken by wind, etc. In July 1934, 90 per cent. of the fallen plants were found to have been injured by the larvae of *S. fuliginosus* and only 10 per cent. by those of cockchafers and wireworms. In 1933, the spring was rainy and the larvae mostly congregated at the root collar or even on leaves lying on the soil, whereas in 1934, when the weather was drier, they usually occurred at a depth of 2–3 ins. In the laboratory, pupation began in the last ten days of June ; and in the field the young weevils continued to appear on the surface of the soil from 25th July until the end of August. They occurred on the surface of the soil or on the leaves of poppies in September but did not cause any damage.

Experiments with plants grown in pots showed that differences in the moisture content of the soil had no effect on the larvae. Infestation in the field was greatly influenced by the time of sowing ; in 1934 40 per cent. of the poppies sown on 18th April were infested, whereas all those sown 10 days later escaped. In laboratory experiments with insecticides, dusts of calcium arsenite (1 : 8), calcium arsenate (1 : 4), or anabasine sulphate (1 : 20), lime being the carrier used in all cases,

gave 100 per cent. mortality of the weevils on the third day after the treatment. Sprays of anabasine sulphate and soap, Paris green or barium chloride were less effective. Of all the insecticides tested, only calcium arsenite scorched the plants.

After hibernating in the soil, adults of *Ceuthorrhynchus macula-alba* first appeared in the field in June, but the mass flight and oviposition occurred in mid-July when the poppies were flowering. Eggs were deposited in seed capsules that were still green. The peduncles were also injured, probably to safeguard the larvae from a too abundant flow of sap. As many as 15–18 larvae often occurred in a capsule, the maximum number found being 21. On reaching maturity they gnaw exit holes in the wall of the capsule, drop to the ground and pupate in the soil; several larvae often use the same exit hole. In the first ten days of August almost all the larvae had entered the soil, and in September the pupal cells only contained young adult weevils. In laboratory experiments to determine the rate of survival of the hibernating weevils at different depths, the lowest mortality (29 per cent.) occurred at a depth of 4 ins. In small scale tests later-sown poppies were less infested.

[Fedorov (S. M.).] **Федоров (С. М.).** ***Pseudococcus citri* Risso, as a Mass Pest of Vine in Azerbaijan.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 73–82, 1 map. Leningrad, 1935. [Recd. 1936.]

Pseudococcus citri, Risso, is widely distributed on vines in Azerbaijan, where it has three generations a year and a partial fourth if the weather is very warm. The females of the last generation overwinter or lay hibernating eggs. In the spring the mealybugs occur on the vine stems under loose bark, and about the end of June they migrate to the young shoots, leaves and setting bunches of grapes. In September or October they return to the stems to hibernate. The author does not consider that winter temperature is the chief factor regulating outbreaks of *P. citri* [*cf. R.A.E.*, A **21** 10, 86], since its numbers decreased in 1933 and 1934 though the preceding winters were mild. On the other hand, observations showed a definite relation between the relative humidity in May–July and the abundance of the mealybug, low humidity resulting in a decrease in its numbers. It appears that a favourable summer always results in an outbreak, even if only a few mealybugs have survived the preceding winter. Parasites and predators were abundant in 1934, the parasites observed being *Pachyneuron coccorum*, L., *Isostasius* sp., *Marietta* (*Perissopterus*) *zebra*, Kurdj., *Anagyrus bohemani*, Westw., *Thysanus niger*, Ashm., *Habrolepis* sp., *Tetrastichus* sp., *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), and two species of Cecidomyiids.

As insecticides applied against *P. citri* affect the quality of the grapes, a consignment of the predacious Coccinellid, *Cryptolaemus montrouzieri*, Muls., was obtained from Leningrad in the autumn of 1933 and mass-breeding and liberation were carried out in the following spring. Owing, however, to dry weather (relative humidity below 80 per cent.), which caused a high mortality of the eggs, the Coccinellids failed to breed in sufficient numbers to control the mealybug. Those released in August, when humidity was higher, produced offspring, but those released in September failed to do so as the temperature was too low. It is therefore concluded that *C. montrouzieri* is unlikely to be of value in Azerbaijan.

[Paĭkin (D. M.) & Goritzkaya (O. V.).] **Пайкин (Д. М.) и Горицкая (О. В.). Fumigation of the *Phaseolus* Beans against *Acanthoscelides obtectus* Say.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 83–89, 6 refs. Leningrad, 1935. (With a Summary in English.) [Recd. 1936.]

The effect of hydrocyanic acid gas, chloropicrin, carbon bisulphide and raw aldehyde (a waste obtained in the production of synthetic rubber) on *Bruchus* (*Acanthoscelides*) *obtectus*, Say, and on the germination of beans was studied in Leningrad and Sukhum in 1933. In tests in small glass chambers at 21–22°C. [69·8–71·6°F.], hydrocyanic acid gas at a concentration equivalent to 5 oz. to 100 cu. ft. gave complete mortality of all stages of the Bruchid in 3 hours, whereas in the case of high concentrations of the other three substances, 100 per cent. kill of all stages (including larvae and pupae inside the beans) was obtained only with an exposure for 24 hours.

Hydrocyanic acid gas used at the same rate did not reduce germination of the beans even with an exposure of 48 hours, whereas chloropicrin and carbon bisulphide applied for the same period decreased it by 50 per cent. and raw aldehyde did so by 40 per cent. within 6 hours.

These tests were confirmed by experiments on a larger scale in which adult Bruchids, eggs and infested seeds were introduced into sacks of beans. The fumigants were used at 9–12°C. [48·2–53·6°F.] with exposures of 24 and 36 hours. Raw aldehyde was not tested because of the injury it had caused to the beans. The results, which are tabulated, showed that hydrocyanic acid gas generated from 10 oz. sodium cyanide per 100 cu. ft. killed all stages of the Bruchid in 36 hours and did not impair the germination of the seeds. When the exposure lasted 24 hours, 15–25 per cent. of the larvae and pupae survived. Carbon bisulphide at the rate of 38 oz. and chloropicrin at the rate of 6·3 oz. to 100 cu. ft. killed all stages in 36 and 24 hours respectively, but considerably reduced the germination of the seeds.

[Éĭdel'man (Z. M.).] **Эйдельман (З. М.). The Methods of physiological Investigations of the Influence of Petroleum Oil Emulsions on Plants.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 140–145, 1 fig., 1 graph, 4 refs. Leningrad, 1935. [Recd. 1936.]

With a view to determining the basic properties of certain oil emulsions designed for the summer spraying of *Citrus*, a study was made of the physiological reactions of the leaves to them. The technique used in investigating the energy of gaseous interchange in photosynthesis and respiration of the leaves and the rate of transpiration is described. It was found that photosynthesis and transpiration may be considerably affected by oil emulsions, their action depending on their viscosity and degree of sulphonation. The process of respiration sharply altered (becoming more intense) only if the emulsions contained components that were toxic to the vegetative tissues.

Observations on sprayed leaves of apples, of which some were left on the tree and others placed in water, showed that cut apple leaves may be successfully used in investigations on the changes in the intensity of photosynthesis. This was so in spite of the fact that apple leaves are more tender than those of *Citrus* and readily give off water, which may considerably interfere with the normal process of photosynthesis.

The different effects of oil emulsions with various degrees of viscosity were also determined by testing the leaves for the presence of

starch, and it was found that the results confirmed those obtained by analysis of changes in photosynthesis. Observations on accumulation of starch may therefore be used in determining the effect of oil emulsions on the activity of leaves in cases when it is not possible to make more complicated investigations requiring special equipment. In the case of leaves of both *Citrus* and apple, light oils disorganised the process of starch accumulation more quickly than heavy oils and sometimes entirely prevented it. With an increase of viscosity of the oil, the disorganisation in synthesis of starch took place much more slowly.

[Vasil'ev (I.).] **Васильев (И.). Pear-bugs as Pests of Fruit Groves. (Abstract).** [*In Russian.*]—*Plant Prot.* 1935 fasc. 7 pp. 151–152, 1 ref. Leningrad, 1935. [Recd. 1936.]

Of the five species of *Stephanitis* that have been recorded in the Russian Union, *S. pyri*, F., in European Russia and *S. oschanini*, sp. n., in Central Asia, are important pests of pears and apples. Characters distinguishing the two species are given. *S. pyri* has the wider range of food-pants, being common on hawthorn (*Crataegus*) and having also been observed on black currant, and various trees other than Rosaceae. *S. oschanini* has 2 generations a year and *S. pyri* 1–3 according to the temperature of the area in which it occurs, its northern range extending to 52°N. lat. Both species hibernate as adults and to a less extent as nymphs, under fallen leaves and in cracks of the bark. The female deposits eggs in the leaves in groups of 25 or more, first puncturing the leaf with its proboscis and then widening the puncture with the ovipositor. Both adults and nymphs feed on the lower surface of the leaves, causing them to dry up and fall, and this affects the yield and quality of the fruit.

Natural enemies of *Stephanitis* spp. are not numerous ; they include the bugs, *Stethoconus cytropeltis* Flor, *Orius* (*Triphleps*) *niger*, Wolff, and *O.* (*T.*) *albidipennis*, Reut., a species of *Cryptothrips*, and larvae of *Chrysopa*. Spraying with contact insecticides and burning fallen leaves in infested orchards in late autumn are recommended for control.

[Pogodina (E. A.).] **Погодина (Е. А.). Ueber Schädlinge der** *Scorzonera tau-saghyz*. [Pests of *S. tau-saghyz*.] [*In Russian.*]—*Trans. Rubb. Guttaperch. Inst.* no. 5 pp. 49–57, 6 figs., 7 refs. Moscow, 1932. (With a Summary in German.) [Recd. 1936.]

A brief account is given of observations in the summer of 1930 in a mountainous district of southern Kazakstan on insects attacking the rubber-producing plant, *Scorzonera tau-saghyz*, which grows wild in thickets on stony soil. The most important pests found were *Mordellistena* sp., *Sphenoptera* sp. and a Curculionid and a Cecidomyiid [which are named and discussed further below (*R.A.E.*, A **24** 710, 711)].

The larvae of the Curculionid, which were not observed after early June, apparently burrow in the spring into the still unopened capitula and completely destroy the ovaries of the flowers ; later they hollow out the seeds, which they fill with excreta.

The adults of *Mordellistena* occurred on the plants in May and the larvae from the middle of June ; the latter tunnel in the flower stems, which consequently are often broken by the wind, and hibernate at the base of the flower stem in a cell made of frass. Analysis of the injured flower stems, of which up to 90 per cent. were sometimes infested, showed that they contained more latex than normal ones.

The larvae of *Sphenoptera* sp. damaged the roots, sometimes killing the plants, but the percentage of infestation was only 3·5.

The Cecidomyiid larvae, which are described, were abundant in the capitula in mid-June after flowering was over. By the end of June they had disappeared in the field, but those left with the seeds in the laboratory lived throughout the winter and spun cocoons in spring, which indicates that they hibernate under natural conditions. The larvae feed on the sap of the seeds, many of which do not germinate. Drying the seed in the sun and frequently turning it over killed a large percentage of the larvae and proved to be a very cheap and simple method of control. All were killed by fumigating the seed with carbon bisulphide, germination not being impaired.

[Vershinskaya (V. G.).] **Вершинская (В. Г.). Ueber Schädlinge des *Parthenium argentatum* Gray.** [Pests of *P. argentatum.*] [*In Russian.*]—*Trans. Rubb. Guttaperch. Inst.* no. 5 pp. 58–66, 6 figs., 7 refs. Moscow, 1932. (With a Summary in German.) [Recd. 1936.]

To determine whether insect pests are likely to prevent the cultivation for rubber of *Parthenium argentatum* in Azerbaijan, observations in recently sown plantations in a selected district were carried out in the summer of 1930. All the pests found were local and on the whole the injury was not severe. Ants caused considerable trouble by carrying away the freshly sown seeds. They were successfully controlled in the spring and summer with a liquid poison bait consisting in 1 part sodium arsenite in 30 parts sugar syrup, but ignored the bait of autumn, when they were collecting the seeds. Young sprouting plants were attacked by the adults of the weevil, *Strophomorphus porcellus*, Schönh., which fed on the leaves and cotyledons at night. The larvae, which feed on humus in the soil, are apparently harmless. The mature plants were attacked by *Calliptamus italicus*, L., *Oedipoda coerulescens*, L., Tettigoniids and Gryllids, and the roots by the wireworms, *Agriotes sputator*, L., and *Melanotus fusciceps*, Gyll., and the Tenebrionid, *Opatrum sabulosum*, L. In tests of soil fumigation, wireworms in small wire cages filled with earth were buried at depths of 4–20 ins. and carbon bisulphide alone or mixed with paradichlorobenzene was injected in 5 spots on a square metre. It was found that both fumigants applied at the rate of 250 or 300 gm. per sq. m. killed all the larvae in dry or damp soil in 24 hours. On the second day carbon bisulphide only acted at a depth of 8 ins. or more and it was completely ineffective after 5 days. Germination of the seeds was not affected by either fumigant, but the mixture reduced the growth of the seedlings, though it was stimulated by carbon bisulphide used alone.

[Emel'yanova (N. A.), Pravdin (F. N.), Kuzina (O. S.) & Lisitzuina (L. I.).] **Емельянова (Н. А.), Правдин (Ф. Н.), Кузина (О. С.) и Лисицына (Л. И.). Biologie und Oekologie von *Sphenoptera foveola* Gebl., im Zusammenhang mit der Frage nach der Saftergussbildung auf *Chondrilla* betrachtet.** [Biology and Ecology of *S. foveola* in Connection with the Question of the Formation of Lumps of Latex observed on *Chondrilla.*] [*In Russian.*]—*Trans. Rubb. Guttaperch. Inst.* no. 6 pp. 10–27, 11 figs., 1 map, 9 graphs, 8 refs. Moscow, 1932. (With a Summary in German.) [Recd. 1936.]

With a view to determining the factors that cause the exudation of latex from *Chondrilla ambigua*, observations were carried out from

mid-April to 1st October 1930 in the sandy areas near the Aral Sea and Lake Balkash in Kazakstan on the bionomics of the Buprestid, *Sphenoptera foveola*, Gebl., which often infests this plant. All stages are described. The beetles occurred from April to October, being most abundant in June and July. They only feed on *Chondrilla*, attacking the tips of the shoots, but the damage caused is not important. Eggs are laid either in the sand at a depth of 1–5 mm. near the plant, or on the plant itself ; no special pits made by the female in the stem [*cf. R.A.E.*, A **19** 227] were ever observed by the author. Better developed plants were infested first. In the insectary, eggs were laid from 19th May till 9th September. The oviposition period of individual females lasted 9–47 days, and the number of eggs laid ranged from 11 to 135. Maximum oviposition occurred in June–July. The egg stage usually lasted 11–14 days, but varied with the temperature, being prolonged to 32–37 days in September. In the field, the first larvae appeared about 1st June ; they at once began to feed on the bark of the stems, causing latex to exude and form lumps. Later they penetrated deeper into the stem and the lumps of latex on the surface ceased to increase in size. In June and July, when a number of young larvae occurred on a plant, the individual lumps joined and formed one large lump, which sometimes weighed up to 8 oz. As a rule, the lumps were formed below the surface of the soil down to a depth of 8 ins. The exudation of latex caused by the larvae may be distinguished from that resulting from other causes by the presence in the lumps of a cavity in the shape of a horseshoe in which the larva lived. The larvae are able to abandon the lumps and pass from one stem to another on the same plant. The infestation, even if severe, does not affect well developed plants.

The author's observations suggest that the life-cycle only requires about a year [*cf. loc. cit.*]. Larvae that hatch in May or June pupate in the following spring, but those that hatch later resume feeding after hibernation. The larvae were parasitised by a Braconid of the genus *Glyptomorpha* (*Pseudovipio*) and by *Pteromalus* sp., but the percentage of parasitism was low.

Further observations showed that this Buprestid is the chief factor concerned in the production of lumps of latex by *Chondrilla*, particularly in the type of country in which the sand is loose but the roots of the plants do not become exposed. Preliminary experiments in using the larvae to obtain latex from uninfested plants showed promising results, as the older ones were not affected by being repeatedly transferred from one plant to another up to 5 times at intervals of 3 and 5 days.

[Kozulina (O. V.) & Rudakova (K. V.).] **Козулина (О. В.) и Рудакова (К. В.).** *Bradyrrhoa gilveolella* **Tr.** [*In Russian.*]—*Trans. Rubb. Guttaperch. Inst.* no. 6 pp. 28–46, 19 figs., 5 graphs, 14 refs. Moscow, 1932. (With a Summary in German.) [Recd. 1936.]

An account is given of field and insectary observations carried out in the summer of 1930 in south-western Ukraine and in the sandy area to the east of the River Suir-Dar'ya in southern Kazakstan on the bionomics of the Pyralid, *Bradyrrhoa gilveolella*, Tr., the larvae of which attack several species of *Chondrilla* [*cf. R.A.E.*, A **23** 339]. All stages are described. There were apparently two generations a year, hibernation taking place in the larval stage. Females lived for up to

24 days and laid from 2 to 286 eggs over a period of 5–10 days. The eggs hatched in 5–15 days. The larval stage is spent in a case of silk impregnated with the excreta containing latex, and covered with particles of soil, etc. The cases are attached chiefly to the root-collar of the plant and fairly often to the roots ; in some instances larvae in Kazakstan burrowed into the stem. The larvae chiefly attack well developed vigorous plants ; the latter are apparently not affected by the infestation.

The most common parasite of the larvae was *Encyrtus* sp., which attacked 6–11 per cent. in the Ukraine and 11 per cent. in Kazakstan. A mean of 350 larvae of this parasite developed in one of the host. Other larval parasites in the Ukraine were the Braconid, *Chelonus* sp., and the Ichneumonid, *Syzeuctus maculatorius*, F., which were scarce, though of the larvae sent from Azerbaijan 50 per cent. were parasitised by the latter species.

Analysis of the larval cases showed that they contained 5·33–18·73 per cent. of rubber, as compared with only 0·31 per cent. in the *Chondrilla* plant itself. This indicates that the larvae are responsible for the increased yield of rubber that they accumulate in their cases. It is recommended to collect the cases at the end of August and in September, when the autumn flight of the adults is over ; larvae found in them should be replaced on the plants to enable them to construct new cases before the cold weather sets in.

[Emel'yanova (N. A.), Pravdin (F. N.), Kuzina (O. S.) & Lisitzuina (L. N.).] **Емельянова (Н. А.), Правдин (Ф. Н.), Кузина (О. С.) и Лисицына (Л. Н.). Kurze Uebersicht der Chondrillaschädlinge der Sandlandschaften von Kasakstan.** [A brief Survey of Pests of *Chondrilla* in the Sand Regions of Kazakstan.] [*In Russian.*]— *Trans. Rubb. Guttaperch. Inst.* no. 6 pp. 47–54, 10 figs., 5 refs. Moscow, 1932. (With a Summary in German.). [Recd. 1936.]

Notes are given on the bionomics of insect pests observed in 1930 on *Chondrilla ambigua*, *C. pauciflora* and *C. brevirostris* in sandy areas near the Aral Sea and Lake Balkhash in Kazakstan. Of a number of Acridids, *Calliptamus italicus*, L., was the most abundant and injurious. Flower buds were severely damaged by the adults of the Meloid, *Mylabris elegantissimus*, Zabl., in late June and July, and though the larvae destroy locust eggs, the damage caused by the adults is sufficiently important to justify their control. The stems of the plants above and below ground were infested by larvae of *Mordellistena* sp. in July. The plants are well grown at this time, and as the tunnels are narrow, the direct damage is slight, but the slips for planting, which are usually cut from the part of the stem that harbours the larva, are apt to decay and the cavities favour the development in them of fungous and bacterial diseases. Overwintered larvae occurred in the underground part of the stems in the spring, and pupae were found from the beginning of May, the pupal stage apparently lasting about 2 weeks.

All the three species of *Chondrilla*, but especially *C. ambigua*, were attacked by the larvae and adults of *Taeniothrips friči*, Uzel, which sucked out the contents of the seeds, the larvae appearing in the inflorescences from the beginning of July. About 60 per cent. of the capitula were thus infested and on an average 30 per cent. of the seeds were damaged. The seeds were also attacked by the larvae of an unidentified moth (which are briefly described) and by a Trypetid, both

being most numerous at the end of the summer, and from the middle of August onward a number of the plants become deformed as a result of infestation by Aphids.

[Rudakova (K. V.).] **Рудакова (К. В.). Eine Chondrillaschildlaus.** [A Coccid attacking *Chondrilla*.] [*In Russian*.]—*Trans. Rubb. Guttaperch. Inst.* no. 6 pp. 55–61, 17 figs., 5 refs. Moscow, 1932. (With a Summary in German.) [Recd. 1936.]

In the summer of 1930 *Neomargarodes* [*chondrillae*, Arkhan. (*cf. R.A.E.*, A **23** 675)] was found on the underground parts of the stems of *Chondrilla kusnezovii* and *C. mujunkumensis* in a sandy area east of the River Suir-Dar'ya in southern Kazakstan, infesting about 50 per cent. of the plants. Cysts alone were present till mid-June, occurring on the stems to a depth of 12 ins. or more. The first mature female was found on 15th June, but no males were observed in the field. Laboratory observations in Moscow on material collected in Kazakstan in October showed that large cysts produce adult females, which are similar in appearance to the larvae and are covered with a white waxy down. Small cysts gave rise in the middle of February to male larvae, which on the second day became motionless and covered with a white wax, and in 4–9 days pupated, eventually producing alate adults. The adult female and all stages of the male are described. Oviposition was observed in the laboratory. The eggs hatch at the end of the summer and the larvae become enclosed in cysts and hibernate in this state.

The fact that the exudation of latex occurred where the larvae were present, and was more abundant when they were numerous, indicates that they were responsible for it. The weight of the lumps of latex averaged 0·35 oz. per plant.

[Emel'yanova (N. A.).] **Емельянова (Н. А.).** Ed. **Schädlinge und Krankheiten kautschuktrager der Pflanzen. Artikelserie I.** [Pests and Diseases of Rubber-producing Plants. Series of Articles I.] [*In Russian*.]—Cr. 8vo, 148 pp., illus., 74 refs. Moscow, Sov.-Un. wiss. ForschInst. Kautschuk u. Guttapercha, 1935. Price 2 *rub.* 50 *kop.* (With Summaries in German.) [Recd. 1936.]

This is a collection of papers giving the results of investigations on the pests and diseases of rubber-producing plants in the Russian Union during the years 1931–33.

In "Notes on the Pests of the Seeds of Tau-saghuiz" by F. N. Pravdin (pp. 28–46), an account is given of the chief insects infesting the seeds of *Scorzoneura tau-saghyz* in the region of the Kara-tau mountains in southern Kazakstan [*cf. R.A.E.*, A **24** 706]. Of these, the Cecidomyiid, *Dasyneura* (*Perrisia*) *tau-saghyzi*, Dombr. [? MS], was the most injurious, over 50 per cent. of the seeds being sometimes damaged by it. The adults are briefly described. The flight begins in the first half of May and oviposition coincides with the period of flowering. The eggs are laid in batches of 3–25 in the capitula, as many as 400 being sometimes deposited in one capitulum by several females. One female may lay 200 eggs. The larvae begin to hatch on the fifth day and at once attack the seeds where they join the receptacles.

After about 3 weeks they crawl upwards along the pappus and drop onto the caudex of the plant, where they spin cocoons. In the laboratory, they remained in cocoons throughout the winter without pupating. They sometimes spin cocoons in the pappus and may thus be introduced into new districts with the seeds. The larvae were not found on any of a large number of other Compositae examined.

Up to about 20 per cent. of the capitula were infested by *Ensina sonchi*, L., which is widely distributed in the Russian Union [*cf. R.A.E.*, A **23** 339]. Usually not more than 3 larvae occur in a capitulum, in which they destroy about 40 per cent. of the seeds. The adults emerge before the seeds are fully mature.

The weevil, *Ceuthorrhynchus tau-saghyzica*, Lukjan. [? MS], damaged 3·5–7·5 per cent. of the seeds. The only other plants on which it occurred were *Tragopogon* sp. and *S. tragopogonoides*. The adults were not observed in the field. Eggs are laid in the flower buds or flowering capitula and the larvae feed on the seeds; mature larvae drop onto the cushion formed by the caudex, where they pupate in cells made of soil. In the laboratory, the adults emerged in the autumn, but remained in the cells throughout the winter. The larvae of a Phalacrid beetle hollowed out the seeds in about 9 per cent. of the capitula in one district in May 1932; they pupated in the soil.

Of the polyphagous pests, the earwig, *Anechura asiatica*, Sem., caused serious damage in 1933, eating out the pistils in the flowers. Late flowering plants suffered most, the yield of seeds being greatly decreased. In preliminary experiments against it with poison baits, the best results (88 per cent. mortality) were obtained with a leavened liquid paste, containing 20 parts flour, 1 part Paris green and 5 parts of sugar, with the addition of essence of peppermint or strawberry. The Tettigoniid, *Metrioptera plotnikovi*, Uvarov, attacked the capitula at the sides; in field insectaries 83 per cent. mortality was obtained with a bait of 30 parts of bran, 3 parts sugar and 1 part sodium arsenite. Various Lepidopterous larvae also fed on the capitula, migrating to them from weeds.

E. A. Pogodina and F. N. Pravdin in "The Quarantine of the Seeds of Rubber-producing Plants" (pp. 47–64) give a detailed account of investigations in southern Kazakstan to determine the best methods of freeing the harvested seeds of tau-saghuiz [*Scorzonera tau-saghyz*] from the larvae of *Dasyneura tau-saghyzi* and *Ceuthorrhynchus tau-saghyzica*, and those of kok-saghuiz [*Taraxacum kok-saghyz*] from the larvae of a Phalacrid beetle and of *C. punctiger*, Gyll. About 80 per cent. of the larvae of these insects leave the capitula before the seeds mature, but it is desirable to harvest the capitula together with the seeds, so that the remainder may be removed from the fields and destroyed. Experiments in which the seeds of *Scorzonera* were dried in the sun or under cover showed that twice as many larvae of the Cecidomyiid abandoned capitula or seeds dried in the sun, and many more larvae were killed. To free the seed completely from the larvae of the Cecidomyiid and the weevil, it should pass through a special cleaning machine that removes the pappus, the larvae being killed in the process. The usual methods of treating the seeds of *T. kok-saghyz* (drying, winnowing, etc.) did not entirely free them from the larvae of either the Phalacrid or *C. punctiger*. Experiments were therefore carried out with fumigation, and from the results it is considered that 100 per cent. mortality of both pests can be obtained by using chloropicrin at the rate of 13–26 oz. to 1,000 cu. ft. for 12 hours, or carbon bisulphide at

the rate of 12½–18 oz. to 100 cu. ft. for 24 hours. Fumigation did not affect the germination of the seeds.

In " Pests of Rubber-producing Plants in the Kursk Region " (pp. 65–74), V. D. Vodolagin gives the results of observations in 1933 on pests attacking tau-saghuiz [*S. tau-saghyz*], kok-saghuiz [*Taraxacum kok-saghyz*] and kruim-saghuiz [*T. gymnanthum*] in a district in central Russia. Of the insects found, the most injurious were wireworms, which attacked all three plants and of which *Corymbites* (*Selatosomus*) *latus*, F., and *Agriotes sputator*, L., constituted 63·8 and 30·7 per cent. respectively, and larvae of the Melolonthid, *Amphimallus solstitialis*, L., which were especially injurious to *Scorzonera*. Considerable damage to *Scorzonera* and *T. gymnanthum* was caused by the Aphids, *Paracletus cimiciformis*, Heyd., which infested the roots at a depth down to 14 ins., and *Trifidaphis phaseoli*, Pass., which only occurred on the upper part of the roots. Since these Aphids migrate from weeds, the destruction of the latter is important. Insects attacking the foliage included *Chaetocnema* sp., *Phyllotreta* sp., *P. vittula*, Redt., and *Phytomyza* sp.

B. V. Dobrovol'skiĭ in " Conditions under which the Method of concentrating Baits may be applied in Fields of Rubber-producing Plants " (pp. 75–80) gives a brief account of preliminary experiments in North Caucasus in 1932. Small heaps of straw and hay placed at intervals in plantations of *Scorzonera tau-saghyz* attracted large numbers of the adults and larvae of Tenebrionids and larvae of the cutworm, *Euxoa segetum*, Schiff., which could then easily be destroyed. Wireworms and other soil pests concentrated on pieces of potato, and on pieces of beet with the addition of chopped garlic, introduced at a depth of 2–3 ins. The results obtained indicate that the baits may be successfully used to attract the pests away from the plants.

A. V. Kuznetzov in " Mechanisation of the Introduction into the Soil of liquid poisonous Substances " (pp. 81–88) gives a detailed description of a machine that is mounted on a tractor plough and releases regulated quantities of chloropicrin or other liquid fumigant into the furrows in the process of ploughing so that the fumigant is immediately covered with soil.

Veltiščev (P. O.). **Die Pflanzenmilben (Tyroglyphidae, Acari) als Hauptursache des Eingehens der Wurzelkautschukgewächse in Transkaukasien.** [Plant Mites as the chief Cause of the Decay of Rubber-producing Plants in Transcaucasia.]—*C. R. Acad. Sci. URSS.* N.S. 1936 **2** no. 3 pp. 123–124. Moscow, 1936.

Recent investigations in Azerbaijan showed that three species of mites, *Histiostoma rostroserratum*, Mégn., *Tyroglyphus* (*Tyrophagus*) *putrescentiae*, Schr., and *Schwiebea talpa*, Oudem., were responsible for the destruction of 75–100 per cent. of two-year-old cultivated plants of *Taraxacum kok-saghyz* and *T. gymnanthum* by infesting the roots. They are most numerous on the roots in March and October and scarce in summer when the soil is dry and has a temperature of up to 80°C. [176°F.]. The plants often remain apparently healthy at the time, but die in the summer of the following year. The mites infest the root from the collar to a depth of 8–10 ins., and the punctures caused by them give access to bacteria and fungi, the injured spots becoming soft. As the maceration progresses, the mites penetrate deeper into the root and before reaching the centre concentrate under the cortex ; the immature

stages occurred in numbers only in this part of the root. In dense plantations, the infestation spreads from one plant to another along the row, irrespective of the thickness of the cortex or the diameter of the root. The mites were also found on various wild Compositae, often in larger numbers than on the cultivated species of *Taraxacum*, but did not kill them.

ISELY (D.) & SCHWARDT (H. H.). **Variations in Codling Moth Injury in northwestern Arkansas.**—*J. econ. Ent.* **29** no. 3 pp. 473–476, 4 refs. Menasha, Wis., June 1936.

This is a review of the prevalence of infestation of apple by the codling moth [*Cydia pomonella*, L.] in north-western Arkansas from 1918 to 1935. Infestation appears to be increasing, though in 1934 and 1935 it was slight. Climatic conditions at the time of flight of adults of the overwintered brood appear to be the most important factor governing variation. During 4 severe years, the temperature during May and June was distinctly above normal and the rainfall below the mean, while during 5 light years, temperature at that time was below the mean and rainfall above normal. As summer temperature is always high enough to be within the range favourable to development and reproduction, the chief danger to the insect is from excessively high temperatures. In 1934 the first brood larvae were as abundant as they had been in the previous year, when there was a tendency to regard the injury as uncontrollable, but an average temperature for July and August of 84–85°F., 6·8°F. above the normal mean, stopped reproduction and infestation almost faded out. Factors, besides climatic conditions and possible acquired resistance to arsenical sprays, that may account for increased infestation are a tendency to plant susceptible varieties of apple and to reduce expenditure on spraying.

DRIGGERS (B. F.) & PEPPER (B. B.). **Effect of Orchard Practices on Codling Moth and Leafhopper Parasitism.**—*J. econ. Ent.* **29** no. 3 pp. 477–480, 6 refs. Menasha, Wis., June 1936.

Studies were undertaken in apple orchards in New Jersey in 1932 to determine the effect of different spray treatments and of clean cultivation on parasitism of the codling moth [*Cydia pomonella*, L.] and of leafhoppers. An examination of eggs of *Cydia* exposed for 3 days in an orchard sprayed with lead arsenate and lime at 10-day intervals from 1st June to the middle of August and with summer oil emulsion at the peak of broods showed that 5 per cent. or less were parasitised by *Trichogramma* compared with 55 or 64·5 per cent. in an unsprayed orchard. Codling moth cocoons collected in August from a heavily sprayed and clean-cultivated orchard revealed 7·5 per cent. larval parasitism and no pupal parasitism. In a heavily sprayed but weedy orchard the percentages were 16·6 and 18, and in an unsprayed and weedy orchard 71 and 9·2. In an orchard divided into 3 parts, the first unsprayed after petal-fall, the second sprayed with lead arsenate and oil for the first brood of *C. pomonella* and nicotine tannate for the second brood, and the third with lead arsenate and oil for both broods, it was oberved in the middle of August that leafhoppers, mostly *Empoasca fabae*, Harr. (*mali*, LeB.), were much more numerous in the third part than in the

second, while the first had least of all. An examination made later showed that the corresponding percentages of parasitism of leafhoppers by *Aphelopus* sp. were 1, 14 and 34.

HOUSER (J. S.) & NEISWANDER (R. B.). **A new and effective Control for Apple Flea Weevil.**—*J. econ. Ent.* **29** no. 3 pp. 481–482. Menasha, Wis., June 1936.

Rhynchaenus (*Orchestes*) *pallicornis*, Say (apple flea-weevil) was first noticed in Ohio in 1907 in orchards where grass was allowed to develop and used as a mulch, and soon spread to all parts of the State in orchards where this method of cultivation was practised. Clean cultivation was for some time the only known method of control, but it is expensive, complicates the work of spraying and harvesting, and in the case of hilly districts, makes the control of erosion almost impossible. The burning of débris under the trees to destroy the hibernating weevils proved expensive and unsatisfactory, as a large proportion escaped. Kerosene emulsion spray was fairly successful if a canvas was spread beneath the tree to ensure the thorough wetting of dislodged insects, but it was incompatible with the treatment for scab, which also had to be applied in the pre-blosoom period. Lead arsenate added to the "pre-pink" and "pink" lime-sulphur sprays had a certain beneficial effect but did not give adequate control. In 1934 and 1935, 2 applications of a spray containing a commercial preparation of barium fluosilicate or cryolite (5 lb. Dutox or Kalo spray, 8 lb. flotation sulphur and 3 oz. Goulac [dry lignin pitch] to 100 U.S. gals. water) at the "pre-pink" and "pink" stages reduced flea-weevil damage to a point well below significant injury. Moreover plots so treated were practically free from apple scab, although in 1935 scab was particularly severe.

FARRAR (M. D.). **Effect of Thrips on Pollination and Blossom Blight in Strawberries.**—*J. econ. Ent.* **29** no. 3 pp. 483–486, 1 fig., 9 refs. Menasha, Wis., June 1936.

A brief account is given of records suggesting that strawberry crops in the United States have been reduced owing to sterility of the blossoms resulting from injury by thrips. A re-examination of the problem indicates that these insects are only in a minor way responsible for limiting pollination. The factors governing the production of fruit by the strawberry are reviewed from the literature. Observations in Illinois from 1932 to 1934 showed that thrips, 98 per cent. of which were *Frankliniella tritici*, Fitch, feed on open flowers and confine their attack largely to the base of the stamens. They migrated to strawberry at blossom time from other food-plants, and collections yielded 0·03–1·2 individuals per bloom during the first week of flowering, 0·3–21 during the second, 4–11 during the third and 15–41 during the fourth. The number of thrips per flower decreases when flowers are most numerous and increases when blooming ceases and few flowers are available. Strawberries produce four groups of flowers, of which the first and second dominate and the third and fourth may set if the plant is vigorous enough. In cage experiments, only first and second group blooms set if more than 5 thrips per flower were present. Non-infested plants set more fruit, but the excess numbers invariably aborted within about 10 days, leaving a crop of fruits from strong

blooms comparable to that on the infested plants. Field tests established that the ability to set fruit is related to order of blooming and plant vigour and not to thrips population.

Butcher (F. G.). **Studies of seasonal Occurrence of Injuries to Potato Tubers in western New York.**—*J. econ. Ent.* **29** no. 3 pp. 486–490, 2 figs., 2 refs. Menasha, Wis., June 1936.

Investigations on potato tuber defects in western New York showed that the amount of injury caused by the various pests involved varied as the season advanced. The injuries considered, each of which is described, were those due to scab, the scab-gnat [*Sciara*] and millepedes. Weekly counts of 36–60 tubers from each of four fields made in the years 1932–35, from the end of August till harvest was begun in the middle of October, showed that the percentage of uninjured tubers always tended to decrease as the season advanced, and there was also a large decrease in the number of tubers showing scab lesions. Injury from scab-gnat larvae became abundant about 2 weeks after maximum scab infection, but showed a consistent decrease after the end of September, while millepede injury was very low at first, but increased markedly throughout the season. It appeared probable that the explanation of the decreases in scab was that the millepedes, as well as scab-gnat larvae, were feeding on the scab lesions. Experiments with marked tubers proved this to be the case. At the end of 3 weeks, practically every marked scab lesion showed signs of millepede injury, while no clean tuber had been attacked. Millepede injuries are thus shown to be secondary, and should be reduced by the reduction of the primary injuries. Where they are serious, the crop should be harvested as early as possible.

Felt (E. P.) & Bromley (S. W.). **Shade-tree Insect Developments.**—*J. econ. Ent.* **29** no. 3 pp. 490–492. Menasha, Wis., June 1936.

Records are given of some of the pests that have recently been abundant on shade trees in the north-eastern United States, including *Cinara* (*Dilachnus*) *strobi*, Fitch, on white pine [*Pinus strobus*]; *Eulachnus rileyi*, Williams, which infests the needles of mugho pine [*P. mugo*], causing them to turn yellow and fall; and the European spruce sawfly, *Diprion* (*Neodiprion*) *polytomus*, Htg., which, since its discovery in the Gaspé Peninsula (Quebec) in 1931, has become widely distributed in the New England States and the Adirondacks.

Farleman (M. G.). **An Experiment for the Control of Juniper Webworm, *Dichomeris* (*Ypsolophus*) *marginellus* Fab.**—*J. econ. Ent.* **29** no. 3 pp. 493–494. Menasha, Wis., June 1936.

In September 1935, a block of Irish juniper in Michigan was found to be badly attacked by the larvae of *Dichomeris marginella*, F., which damage the trees both by feeding and webbing [*R.A.E.*, A **10** 279; **22** 530]. Over 50 per cent. of the larvae were already in tubes of webbing. One plot was thoroughly sprayed with 40 per cent. nicotine sulphate (1 : 400) with the addition of a sulphated higher alcohol spreader at the rate of 6 oz. to 100 U.S. gals. A second plot was sprayed with a proprietary insecticide. After 2 weeks, the latter had not been a success, and both plots were sprayed again with the nicotine sulphate spray. A week later, 95·7 per cent. of the larvae had been killed by the spray, which did no harm to the foliage.

Polivka (J. B.) & Houser (J. S.). **Pine-tip Moths of southern Ohio.**—*J. econ. Ent.* **29** no. 3 pp. 494–497. Menasha, Wis., June 1936.

A survey of pines in Ohio in 1934 and 1935 showed that the tip moths that had been doing considerable damage in the southern part of the State for many years were *Rhyacionia comstockiana*, Fern., *R. frustrana*, Comst., and *Dioryctria* (*Pinipestis*) *zimmermanni*, Grote. The injury caused by the first two species is briefly described [*cf. R.A.E.*, A **18** 392; **21** 353; **22** 598]. The larva of *P. zimmermanni* enters the leading shoot, frequently a twig infested by *R. comstockiana*, but no pitch mass results. It hollows the branch for several inches, usually pupating within it, but sometimes it pupates on other parts of the tree. A list of the species of pine infested by one or more of the tip moths is given, and includes all the species studied either in native stands or in plantings, with the exception of white pine (*Pinus strobus*). The percentages of infested trees (ranging from 0 to 34·1) of the several species examined in 1934 and 1935, and the average number of damaged tips per infested tree (ranging from 1 to 3·6) are given. With the exception of *P. ponderosa*, the species most seriously infested are those the native habitat of which most closely resembles that of the area studied.

It was observed that *R. comstockiana* and *P. zimmermanni* have only one generation a year, while *R. frustrana* has two. Adults of the first species emerged from 25th May to mid-June in 1935, while in cages adults of the second emerged from 4th July until 10th August in 1934 but in 1935 only from 25th July. In 1935, adults of *R. frustrana* began to emerge in April and those of the new generation in July. The overwintering pupae were found as early as August.

Deay (H. O.) & Amos (J. M.). **Dust Treatments for protecting Beans from the Bean Weevil.**—*J. econ. Ent.* **29** no. 3 pp. 498–501. Menasha, Wis., June 1936.

Preliminary experiments in Indiana indicated that of the 15 materials tested to prevent infestation of stored beans by *Bruchus* (*Mylabris*) *obtectus*, Say, 8 gave perfect or nearly perfect protection, at the proportion of 1 part to 2 parts beans by volume, and these were selected for further tests. A list of the 7 rejected materials and the results obtained with them are given. In the final tests, in which beans mixed with the various materials and untreated controls were exposed in open bags for 6 months together with heavily infested beans in a room in which the temperature varied from 61 to 101°F., 54 per cent. of the untreated beans became infested. Dusting talc gave perfect, and Anderson clay, Dawson clay and Dutox (80 per cent. barium fluosilicate) almost perfect protection at all proportions used (1 part to 4, 10, 25, 50 and 75 parts beans). Hydrated lime in the same proportions was almost as effective. Coal ashes prevented infestation at 1 : 2 and 1 : 4, and allowed less than 0·5 per cent. infestation at 1 : 10 and 1 : 25. Wood ashes gave perfect protection at 1 : 2, but allowed an infestation of 1 per cent. or more at lower proportions. Flour was ineffective at proportions below 1 : 2. Dawson clay appeared to be the most repellent substance, as fewer dead Bruchids were found in the bags containing it. The effectiveness of non-poisonous materials was in direct proportion to their adhesiveness to the beans, but the most adhesive were difficult to remove when preparing the beans for cooking.

None of the materials affected the germination of the beans or impaired their cooking quality, but it is inadvisable to use Dutox, which is poisonous, for beans that are to be eaten.

DUDLEY, jr. (J. E.), BRONSON (T. E.) & CARROLL (F. E.). **Experiments with Derris as a Control for the Pea Aphid.**—*J. econ. Ent.* **29** no. 3 pp. 501–508. Menasha, Wis., June 1936.

This is an account of experiments with derris against *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) on peas in Wisconsin, some of the results of which have already been noticed [*R.A.E.*, A **24** 601]. Seven tests were made during the growing season with sprays consisting of ½ lb., 1 lb., 3 lb. and 5 lb. ground derris (3·7 per cent. rotenone and 16·1 per cent. total extractives by the carbon tetrachloride method) per 100 U.S. gals. water with the addition of a commercial diphenyl butyl sodium sulphonate spreader and wetting agent used at the rate of 1 part of a 40 per cent. aqueous solution in 600 parts of water. In one test practically all the Aphids were killed and the plants were kept from becoming reinfested for more than a fortnight, and in four others the mortality averaged 93 per cent. In the two remaining tests mortality records were interrupted by rain, but in one case an average mortality of 45 per cent. was noted after 4 hours, and in the other 81 per cent. after 16 hours. The lowest concentration gave an average mortality of 94 per cent., which was as high as that given by the greater concentrations. The spreader when used alone at the same concentration killed 24 per cent. of the Aphids, and at concentrations of 1 : 200 and 1 : 100, it killed 75 per cent. and 72 per cent. respectively. Ground derris and a bentonite carrier, 1 : 3 (0·925 per cent. rotenone), gave an average mortality of 69 per cent. after several days.

The derris employed in the autumn experiments [*loc. cit.*] contained 3·2 per cent. rotenone and 13 per cent. total extractives ; it was used with the same spreader and in the same proportions as in the summer experiments. A heavy application of derris without any spreader or wetting agent gave a slower and inferior but satisfactory control. Severe infestation was satisfactorily reduced when sodium lauryl sulphate (a powder) at 9 oz. per 100 U.S. gals. or sodium oleyl sulphate (a liquid) at 1 : 600 was used as spreader and wetting agent. These agents in the proportions named combined with derris at ½ or ¼ lb. per 100 U.S. gals. gave an average mortality of 94 per cent. Alone they killed from 15 to 25 per cent. of the Aphids. Diphenyl butyl sodium sulphonate alone at 1 : 600 in 2 tests killed 15 and 6 per cent. The mortality of the Aphids on untreated plants was from 2 to 5 per cent.

BUSHNELL (R. J.). **Effects of some inorganic Salts on Development and Reproduction of the Bean Weevil** *Acanthoscelides obtectus*.—*J. econ. Ent.* **29** no. 3 pp. 509–514, 9 refs. Menasha, Wis., June 1936.

Since it has been shown that the mineral content of beans depends on variety and stage of development, it was thought desirable to investigate the effects of some inorganic salts on the development and reproduction of *Bruchus* (*Acanthoscelides*) *obtectus*, Say, by adding varying amounts of a single salt to the normal food. The amount of the salt determines the extent of its effect on the Bruchid, too high a concentration proving lethal.

Concentrations of each salt were selected, concentrated enough to affect the development but not to kill all of the Bruchids, and 25 gm. of white navy beans were treated with 12 cc. of each, and then dried to their original weights. The salts used were calcium chloride, sodium chloride, sodium nitrate, potassium chloride and ammonium chloride at a molar concentration of 0·01, sodium sulphate at 0·008 and ferric sulphate at 0·002. One control was untreated and one treated with distilled water. Potassium chloride and sodium sulphate had an inhibiting influence on oviposition when the females had been reared on normal beans. The other salts used had slight or no influence on oviposition. The percentages of mortality of the progeny were 12·1 for the controls, 22 for calcium chloride, 26 for sodium chloride and sodium nitrate, 35·4 for sodium sulphate, 34 for ferric sulphate, and 45 for potassium chloride. Death of the young larvae accounted for most of the mortality, individuals in beans treated with sodium sulphate alone dying in the pupal condition.

At 30°C. [86°F.], 34–43 days were required for complete development in controls ; in beans treated with sodium chloride, sodium nitrate, sodium sulphate and potassium chloride development required 2–8 days more, the larval, prepupal and pupal stages being prolonged. Ferric sulphate prolonged the larval stage only by 2–3 days. Calcium chloride and ammonium chloride did not affect the rate of development. Of the second generation reared at 25°C. [77°F.] in beans treated with the same salts as those in which their parents had matured, the controls and those reared in beans treated with ammonium chloride or calcium chloride took 42–52 days to develop. Those in beans treated with sodium chloride, sodium nitrate, sodium sulphate or potassium chloride required 4–7 days longer, and those in ferric sulphate 2 days longer.

In comparison with the controls, the adults resulting from larvae reared in beans treated with calcium chloride or ferric sulphate were heavier in both average live and dry weights, possibly owing to the effects of these salts on respiration. Those from larvae reared on beans treated with ammonium chloride were lighter in live weights but heavier in dry weights. Sodium nitrate and sodium chloride produced adults lighter in both weights. Potassium chloride appeared to have a similar effect. Individuals treated with sodium sulphate were not appreciably different from controls in average dry weights.

The average number of offspring per female in the second generation was much larger than for the control groups when the beetles had been reared in beans treated with calcium chloride or ammonium chloride. Ferric sulphate had no significant effect. Sodium chloride, sodium nitrate, sodium sulphate and potassium chloride all reduced the number of offspring capable of reaching maturity, potassium chloride causing the greatest reduction. There is thus an apparent correlation between dry weight and fecundity.

When pupae of the first generation were transferred to untreated beans and the adults allowed to oviposit, the higher relative fecundity of beetles reared on beans treated with calcium chloride was corroborated and their eggs were found to be more viable. Ferric sulphate reduced viability but increased the number of eggs per female. Beetles reared in beans treated with sodium nitrate laid as many eggs as the controls but only half of them hatched.

Potassium chloride, sodium chloride and calcium chloride in a third of the quantities used in the first experiment did not make the rates of development appreciably different from the controls at 25°C. [77°F.].

The smaller quantity of potassium chloride was less toxic to the young larvae. Beetles reared in beans treated with sodium chloride or potassium chloride were lighter than the controls in dry weights, but calcium chloride made no appreciable difference to the weight.

COTTON (R. T.), YOUNG (H. D.) & WAGNER (G. B.). **Fumigation of Flour Mills with Hydrocyanic Acid Gas.**—*J. econ. Ent.* **29** no. 3 pp. 514–523, 4 figs. Menasha, Wis., June 1936.

This is an account of observations on the degree to which the efficiency of hydrocyanic acid gas as a fumigant against insects infesting flour mills is affected by various methods of production and application, by the type of construction and preparation of the mills and by wind velocity. Measurements throughout are per 1,000 cu. ft. Samples of air taken at intervals during exposure showed that the gas, though lighter than air, does not tend to concentrate at the top of a building. At a dosage of 7·6 oz., gas generated from a mixture of sodium cyanide and dilute sulphuric acid into open mill space rose because it was hot, but fell as it cooled so that after 40 minutes the concentration at both floor and ceiling was 4 oz. after which it fell uniformly at all levels. A dosage of 11·25 oz. produced by vaporisation of liquid HCN in open mill space gave a uniform concentration of 1 oz. after 10 minutes and remained fairly uniform, rising to a maximum of 1·75 in 30 minutes and then falling. This low concentration was probably due to the loose construction of the mill and a wind velocity of 23 miles per hour. In a wooden frame mill, consisting of a basement and 3 floors, fumigated as evenly as possible by the first method with a dosage of 8·2 oz., the gas concentration over the whole mill reached a state of equilibrium at 6·3 oz. in about 30 minutes and fell uniformly throughout the rest of the period. In a concrete and steel mill, all the roof vents of which were covered with metal caps, fumigated with a dosage of 8·6 oz. by the liquid method, gas concentration on the fourth, fifth and eighth floors was identical (over 2 oz.) at the end of 18 hours, and the maximum concentration obtained was 6·8 oz. In a wooden frame mill with sheet-metal covering, fumigated on the same date by the same method with 9·7 oz., the concentrations, never high, dropped rapidly and within 3 hours were less than 2 oz.

When the open mill space is fumigated it is necessary to dismantle machinery and clean out the milling stock. To save this expense the application of liquid HCN directly into the machinery by pipes coming from outside the mill was tried. By this method higher concentrations can be obtained with less gas, and fumigation can be carried out twice as often with no increase of cost. In a comparative experiment, the maximum concentration found in the machinery when the open space method was used was 5·5 oz. and at the end of 1 hour concentration was not above 2·05 oz. in any part of the mill, whereas when the fumigant was applied directly to the machinery a concentration of 124 oz. was found in the elevator boot at the end of 40 minutes and 50 oz. at the end of 109 minutes. In 15 experiments with adults and larvae of *Tribolium confusum*, Duv., covering all three methods of fumigation, the kill was in no case less than 96 per cent. The liquid open mill space method was the most effective but also the most expensive. The introduction of the fumigant directly to the machinery was the least expensive and the kills compared very favourably. The system of generating gas from sodium cyanide was the least satisfactory. An

experiment on the effectiveness of short periods of exposure in a frame and sheet metal mill fumigated by the machinery-piping method showed that the percentages of insects killed by 4 hours' exposure were as great as those killed by longer exposures. In 6 fumigations by the machinery-piping and liquid methods 100 per cent. of the eggs of *T. confusum* exposed in glass vessels under accumulations of flour were killed.

WORTHLEY (H. N.) & FREAR (D. E. H.). **Pre-harvest Spraying of Apples for Removal of Lead Residues.**—*J. econ. Ent.* **29** no. 3 pp. 524–526, 1 ref. Menasha, Wis., June 1936.

Investigations in Pennsylvania into the use of a pre-harvest spray to reduce lead arsenate residue on apples and so obviate the necessity for special washing [*cf. R.A.E.*, A **24** 9] or permit the use of a milder wash yielded poor results [but *cf.* **24** 64]. Only the lead residues were estimated. The trees had received 5 cover sprays of lead arsenate (3 lb. in 100 U.S. gals.) with lime-sulphur, or with flotation sulphur and fish oil (1 : 400), and one batch received, in place of the fifth application, lead arsenate and mineral oil (1 : 100). A month before harvest the trees were sprayed with hydrated lime, ammonium nitrate or paste Vatsol (10 lb., 8 lb. and ½ lb. respectively per 100 U.S. gals.) each applied at the rate of 10 U.S. gals. per tree. None of these sprays appeared to increase the effect of weathering significantly, except that Vatsol reduced the residue on fruit sprayed with lead arsenate and mineral oil by 15·7 per cent., though that remaining at harvest was far above the legal tolerance. Rainfall during the 5 weeks preceding harvest was half the normal. Earlier application of the supplementary spray followed by a heavy drenching with clear water might increase the effect. Lime was the only supplementary spray that assisted the subsequent removal of residue by washing with hydrochloric acid.

WORTHLEY (H. N.). **Codling Moth Spraying Experiments in Pennsylvania in 1935.**—*J. econ. Ent.* **29** no. 3 pp. 527–532, 4 refs. Menasha, Wis., June 1936.

An account is given of experiments with sprays against *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in southern Pennsylvania. From the results it is concluded that the population of the moth has for some years been considerably reduced by lead arsenate, which should still be used in the first-brood cover sprays. Experiments in 1935 were concerned principally with "stinging," spray residues, and spray injury. Of the ovicides tested, 2 fixed-nicotine compounds (Blackleaf 155A and Blackleaf 155B), of which Blackleaf 155A was used in conjunction with oil (Orthol K), were almost equally effective, and it is suggested that the spray containing oil should be used only when sulphur has not been applied for at least a month. Washing cannot apparently be avoided unless the use of lead arsenate is reduced practically to vanishing point, but the residues from 5 cover sprays of lead arsenate and fish oil, or from 3 cover sprays of lead arsenate followed by mineral oil, can be brought below tolerance by exposure for one minute to cold 1½ per cent. hydrochloric acid in a flotation washer. Spray injury suggested that 5 cover sprays of lead arsenate were too many in some orchards, or on some varieties, that more than 3 weeks should be allowed between the application of sulphur and mineral oil, and that

certain fixed-nicotine compounds are less injurious to the fruit, and possibly to the foliage also, than is lead arsenate. No perfectly safe and highly effective combination of materials and schedules was found, the problem being complicated by the incompatibility of liquid lime-sulphur with fish oil, mineral oil and fixed-nicotine compounds. Flotation sulphur can be used with fish oil and with the fixed nicotine, and copper fungicides with mineral oil.

Siegler (E. H.), Munger (F.) & Smith (L. E.). **Laboratory Tests of Phenothiazine against Codling Moth Larvae.**—*J. econ. Ent.* **29** no. 3 pp. 532–537, 2 refs. Menasha, Wis., June 1936.

Preliminary investigations were made into the relative toxicity to larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., of lead arsenate and phenothiazine [thiodiphenylamine]. This was prepared by 3 methods, in the first of which [*R.A.E.*, A **23** 652] iodine was used as a catalyst, and in the second aluminium chloride; the third was a semi-commercial adaptation of the latter. The product obtained by the first 2 methods was pure but that by the third method contained only 55 per cent. thiodiphenylamine.

The tests were made by the apple plug method [**21** 338], using fruit that had been sprayed in the orchard or in the laboratory. A wetting agent was necessary with the thiodiphenylamine to get it into suspension. The semi-commercial thiodiphenylamine (2 lb.) with bentonite (2 lb.), fish oil (1 U.S. qt.) and water (50 U.S. gals.) applied in the orchard did not retain its effectiveness as long as lead arsenate (1½ lb. per 50 U.S. gals. water), which allowed a smaller percentage of entries but a much larger percentage of "stings." When applied in the laboratory, it was not so toxic as pure thiodiphenylamine prepared by the first method, bentonite being used as wetting agent for both. Other wetting agents failed to increase its toxicity. Pure thiodiphenylamine (2 lb. to 50 U.S. gals. water) prepared by the second method with fuller's earth (6 lb.) as a wetting agent was more effective than lead arsenate at the same rate.

Hough (W. S.) & Jefferson (R. N.). **Tests of Insecticidal Efficiency of some Contact Sprays against Codling Moth Eggs.**—*J. econ. Ent.* **29** no. 3 pp. 537–541, 4 refs. Menasha, Wis., June 1936.

This paper presents the results of tests made in Virginia during 1934 and 1935 against eggs of the codling moth [*Cydia pomonella*, L.] with summer oil alone and in combination with Bordeaux mixture, and also of comparisons of the ovicidal efficiency of certain vegetable oils and other well-known contact insecticides. In northern Virginia, where the work was carried out by the senior author and E. A. Walker, eggs deposited on Kieffer pear leaves were suspended from apple trees. Eggs of different but known ages were used, but there was no consistent relation between the age of the eggs and the effectiveness of the ovicide, except in the case of nicotine, the effectiveness of which increased with the age of the eggs. When nicotine sulphate (1 pt. to 100 gals.) was used against eggs less than 48 hours old, 67·1 per cent. hatched, but when the eggs were 2 and 3 days older, only 0·2–0·6 per cent. hatched. The control obtained with an oil (Orthol K) emulsion at the rate of 2, 3, and 4 qts. per 100 gals. (over 90 per cent. in each case) was reduced by Bordeaux mixture, but when 4

qts. oil were used the reduction was slight. Oil in combination with Bordeaux mixture in 1935 resulted in a relatively high percentage of control, except in the case of white oil with pine-tar soap and Bordeaux mixture, when the run-off appeared to be excessive. Summer scalecide failed to give satisfactory control, as did also paraffin-wax emulsion, except when the undiluted stock emulsion, containing 20 per cent. wax, was used. A wetting agent (Areskap) at the rate of 0·1 per cent. by volume caused excessive run-off of all sprays in which it was used.

Experiments were carried out by the junior author with eggs laid on pieces of glass. At comparable oil dilutions certain vegetable oils were equal to or slightly more effective than refined petroleum oil; cottonseed oil, maize oil, and soybean oil at 4 qts. per 100 gals. giving better control than Orthol K emulsion (80–83 per cent. oil) at 5 qts. The number of eggs sprayed and hatched and the control obtained with each ovicide in each series of tests are given in tables.

GARMAN (P.). **Notes on the Apple Maggot.**—*J. econ. Ent.* **29** no. 3 pp. 542–544, 1 ref. Menasha, Wis., June 1936.

Rhagoletis pomonella, Walsh, was successfully reared in winter in a room at a temperature of 76°F. with 60 per cent. relative humidity, when fed on honey or honey and yeast [*R.A.E.*, A **22** 96] and water. After mating had occurred, green apples were placed in the cages for oviposition. Adults lived for a considerable time, but laid few eggs, on fruit coated with lead arsenate, cryolite, or, to a lesser extent, derris. Talc, sulphur and lime were all repellent to ovipositing females in laboratory experiments, and in field tests in Connecticut sprays of lime and glue considerably reduced infestation, but were not so effective as lime and lead arsenate. The lead residue was, however, above tolerance. Lead arsenate had no repellent action on ovipositing females collected in summer, whereas lime had considerable action though less than during winter.

WOODSIDE (A. M.). **Comstock's Mealybug as an Apple Pest.**—*J. econ. Ent.* **29** no. 3 pp. 544–546, 1 ref. Menasha, Wis., June 1936.

Pseudococcus comstocki, Kuw., has often been found on apples in the central Atlantic States, but only in small numbers. In 1934, however, it was a serious pest of orchards in central Virginia, where there had been a light attack in the previous year. It was abundant in July, on fruits, trunks and branches, especially on pruning scars, but there were only a few scattered individuals on the foliage. Infestation of the fruits was heaviest in the calyx and stem basins. Direct damage from feeding was very slight, the chief loss resulting from the deposits of honeydew, which supported the growth of a sooty fungus, too tenacious to be removed by washing, and affecting 50 per cent. of the fruit. There was no loss in 1935, after successful control measures during the intervening winter, but in the autumn the mealybugs were again present in large numbers and over a wider area. The life history appeared to be similar to that recorded from northern Virginia [*R.A.E.*, A **13** 567]. Overwintered eggs hatched from 10th May to 15th June and first-brood eggs from early July. First-brood adults were present by the end of July. Some second-brood eggs hatched during the latter part of August and early September, but the proportion was small.

As the egg masses were far too dense and sheltered in the rough bark for the eggs to be reached by a spray, the trees were first scraped and the rough spots cleaned with wire brushes. A dormant spray containing 4 per cent. tar oil and 2 per cent. petroleum oil was then applied to the trunks and branches. This treatment killed nearly all the eggs, but some matured on the smaller branches, which had not been scraped. A 7 per cent. emulsion of kerosene was less effective. Nicotine sulphate (1 : 800) applied during the period of the first 2 cover sprays (21st May and 5th June) gave satisfactory results. A 15 per cent. emulsion of tar oil, applied during June and July with paint brushes to such colonies as appeared on the trunks and larger branches, was very effective and did not damage the trees. Nicotine sulphate (1 : 600) and soap (2 lb. per 100 U.S. gals.) applied in a 3 : 6 : 100 Bordeaux spray late in July killed all exposed mealybugs but reached only 50 per cent. of those in the calyces. Comparable results were obtained in August with nicotine sulphate in dilutions up to 1 : 800 in combination with either Bordeaux (4 : 8 : 100), soap (6 lb. to 100 U.S. gals. water) or penetrol (1 : 200), with a derris preparation (8 per cent. derris derivatives) at the rate of 6 lb. to 50 U.S. gals. water, and with a 0·75 per cent. rotenone dust.

Reed (T. W.). **Problem of European Red Mite on Prunes in western New York.**—*J. econ. Ent.* **29** no. 3 pp. 546–550, 4 figs. Menasha, Wis., June 1936.

Experiments were carried out in western New York during 1935 to find a control programme against *Paratetranychus pilosus*, C. & F. (European red mite) and leaf-spot on prunes, more satisfactory than a dormant application of 3 per cent. lubricating oil followed in summer by lime-sulphur, which scorches the foliage, or lubricating oil followed by wettable sulphur, which is only satisfactory in years of light infestation by the mite. When the first sprays were applied, eggs were scarce and consequently the initial population was very low, but numbers increased as the season advanced, reaching the maximum, when unchecked, in late July or early August. Summer oils applied at the shuck-fall stage or later killed the mites and prevented the eggs from hatching, but produced spotting of the fruit if applied in July or August. A spray of 1½ per cent. summer oil emulsion containing 88 per cent. oil in Bordeaux mixture (2 : 4 : 100) at the shuck-fall stage did not cause spotting and checked the mites, which did not become numerous till September, but it was not possible to determine its effectiveness against leaf-spot. The relative merits of various summer oils and dormant oil treatment are shown by a table, there being little difference in the effectiveness of the summer oils. Mites were less numerous on trees on which no sulphur had been used. Vigorous and moderately vigorous unsprayed trees had respectively 2,440 and 7,900 mites on 100 leaves. Good culture to increase the vigour of the trees would appear to be of primary importance in any programme for controlling the mite.

Heal (R. E.). **Derris Insecticides. VI. Summer Control of European Red Mite on Apple with Derris and Neutral Wetting Agents.**—*J. econ. Ent.* **29** no. 3 pp. 550–556, 2 refs. Menasha, Wis., June 1936.

A serious outbreak of *Paratetranychus pilosus*, C. & F., occurred on apple in New Jersey in July 1935, in orchards that had received

delayed dormant oil spray as well as in those that had not. The presence of sulphur residues on the leaves precluded the use of the usual oil emulsion spray, and the possibility of substituting derris was investigated. Neutral wetting agents were tested as lead arsenate residues made soap unsuitable. Derris in the form of prepared dusts ($\frac{3}{4}$ and 1 per cent. rotenone) at 5, 10 and 15 lb. per 100 U.S. gals., combined with 8 and 10 oz. of one of three neutral salts of sulphated butyl diphenyl compounds, practically free from sodium sulphate (Aresket, Areskap, and Aresklene) as wetting agent, gave a good control in all combinations. The kill was usually over 90 per cent. when applications were thorough. All the wetting agents were as satisfactory as soap. As the sprays had no ovicidal effect, 2 applications were necessary, at an interval of 1–2 weeks according to the weather and consequent length of the immature stages of the mite. In comparative trials, finely ground derris root (4 per cent. rotenone) at $1\frac{1}{4}$ and 2 lb. per 100 U.S. gals. with Aresket (8–12 oz.) or soap (0·2 per cent.) gave better control than the above sprays, which, moreover, left a deposit on the fruit. Skim milk (1 lb. to 100 U.S. gals.) was unsuccessful as a wetting agent. Prepared derris dust (1 per cent. rotenone) was of no value when applied as a dust.

HARTZELL (F. Z.). **Tar-oil and Lubricating-oil Sprays in Relation to Rosy Aphid Control and to Winter-injured Trees.**—*J. econ. Ent.* **29** no. 3 pp. 556–561, 1 fig., 2 refs. Menasha, Wis., June 1936.

The relative efficiencies against eggs of *Anuraphis roseus*, Baker, of tar oil and lubricating oil sprays, and the effects of these sprays on apple trees that had a single growth period following a severe winter, were investigated in western New York [*cf. R.A.E.*, A **23** 452] during the spring of 1935. An opportunity was afforded for further proving the validity of concentrations that had been tentatively suggested [**22** 408]. Creosote oil (tar distillate) even at a concentration of 2·4 per cent. was sufficient to secure a high degree of control (average 96·7 per cent. on the basis of counts of infested leaf clusters in early July), and its effect was not increased by the presence of lubricating oil when the latter did not exceed 3 per cent. All commercial brands and tank-mixed emulsions, at the same dilution of creosote oil, gave similar results. Water-gas tar oil with a boiling range similar to that of creosote oil had high ovicidal value, but data are insufficient to determine whether it can be substituted for creosote oil at the same concentration. Cresylic acid (0·5 per cent.) in lubricating oil (3 per cent.) gave variable control. Nicotine sulphate (1 : 800) in 3 per cent. lubricating oil, applied during the green-tip stage, gave results similar to cresylic acid and oil. When it was used at a concentration of 1 : 400, excellent control was obtained. Concentrations of creosote oil, lubricating oil or both that caused considerable twig injury in 1934 [**23** 452] caused no such injury in 1935. The strength of the trees did not give a true indication of their ability to tolerate various dilutions of the oils. All the oils appear to have reduced slightly the set of the fruit on some trees. Water-gas tar oil appeared less toxic to fruit buds than creosote oil at the same concentration.

A graph is given showing the stages of the buds at which should be applied various mixtures found to be efficient for the control of *A.*

roseus alone or with *Eucosma* (*Spilonota*) *ocellana*, Schiff. (eye-spotted bud moth) or *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst. (San José scale).

Chapman (P. J.) & Dean (R. W.). **Further Studies of Larvicides to control Fruit Tree Leaf Roller, with special Reference to Lead Arsenate and Supplements.**—*J. econ. Ent.* **29** no. 3 pp. 561–570, 2 figs. Menasha, Wis., June 1936.

The trials of spray combinations against *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., on apple, begun in New York State during 1934 [*R.A.E.*, A **23** 459], were continued in 1935. A descriptive list is given of all the materials tested. Dormant sprays were applied at the rate of 11·6 U.S. gals. per tree and larvicidal sprays at 13·6 U.S. gals. per tree. All controls were sprayed with lime-sulphur. Weather conditions, which in 1934 had been favourable to control, were bad in 1935, when low temperatures extended hatching, and frequent precipitation hastened the appearance of new growth so that the maintenance of adequate spray coverage was difficult. Efficiency computations were complicated by the fact that some fruits injured by *T. argyrospila* survive attack while others do not; the number of injured fruit found at harvest does not, therefore, represent the whole damage. Moreover, as infestation is chiefly concentrated on the lower part of the tree, within 7 ft. of the ground, and few fruits survive attack in this zone, the percentage of injured fruits at harvest is governed by conditions existing in the upper parts of the trees. Therefore the percentage of control was calculated not only from the actual yield but also from a theoretical yield determined from data obtained on a batch of very lightly infested control trees. The latter basis is used for the control figures given below. A 6 per cent. oil spray functioning as an ovicide was nearly as effective as the better lead arsenate treatments if the damage attributable to the oil is disregarded. With the same reservation, maximum efficiencies were shown to result where both oil and arsenical were used. Emulsions containing 8 per cent. oil caused pronounced loss, but the reductions in crop from 6 per cent. or less may be justifiable in view of the insect control. Lead arsenate sprays applied directly after and 7 days after blossoming contributed more to control than pre-blossom sprays. In one instance 2 post-blossom sprays gave approximately the same percentage control (86·9) as 2 pre- and 2 post-blossom ones (85·2). In most cases the first pre-blossom spray was applied on 29th April. Lead arsenate at 6 lb. per 100 U.S. gals. water was more efficient than at 3 lb. in 4 out of 5 comparisons. Differences in favour of the 6 : 100 rate ranged from 40·4 per cent. when the lead arsenate was combined with fish oil and wettable sulphur to no apparent difference when it was in combination with 0·5 per cent. mineral oil and wettable sulphur and gave 85·2 per cent. control. Mixtures of lime-sulphur and lead arsenate were poorer than mixtures of wettable sulphur and lead arsenate by as much as 15 per cent. Nicotine preparations were not so successful as in 1934. Russetting of the fruit was caused by cuprous cyanide, which gave a control of 37·7 per cent., and by a combination of lead arsenate with a sodium oleyl sulphate compound (Grasselli SS3) as sticking, wetting and spreading agent, which effected 77·2 per cent. control. Lead arsenate and resin fish-oil soap caused foliage injury and gave only 26·6 per cent. control.

SCHOENE (W. J.). **Partial second Brood of Plum Curculio in Virginia.**—*J. econ. Ent.* **29** no. 3 pp. 571–573, 8 refs. Menasha, Wis., June 1936.

Investigations during the seasons 1902–1929 into the development of a partial second generation of *Conotrachelus nenuphar*, Hbst., in the eastern United States are discussed from the literature, and it is concluded that such a generation often occurs in the southern States but not in the northern. Investigations in Virginia during the seasons 1930–34 [*R.A.E.*, A **23** 728] provided no evidence of one in that State, but in 1935 second-generation larvae were present both in the peach orchards and in the laboratory. Of 14 first-brood females captured, 6 oviposited, laying a total of 304 eggs, and of 10 reared in the insectary 3 oviposited, laying 128. It is believed that in some districts 50 per cent. of the first-generation females deposited eggs, and it is now apparent that the larvae in peaches in August 1929 belonged to a second generation. The summers of 1929 and 1935 were wet, whereas those of the intervening years were dry. It is concluded that Virginia is on the border between the one-brooded and the two-brooded areas and that in favourable seasons a partial second brood occurs.

GOULD (E.). **Notes and Observations on the Pistol Case-bearer.**—*J. econ. Ent.* **29** no. 3 pp. 573–575. Menasha, Wis., June 1936.

A brief account is given of the history of *Coleophora malivorella*, Riley, on apple in West Virginia [*cf. R.A.E.*, A **18** 403; **20** 468], where it first caused serious injury in 1927. Since that year outbreaks in widely separated orchards in the north-east of the State have in some cases necessitated special spray measures. Outbreaks have always been worst in commercial orchards, indicating that parasites normally effect control. Of 36 parasites reared, 5 were common enough to be of importance. These were *Microbracon pygmaeus*, Prov., *Eurydinota lividicorpus*, Gir., *Hemiteles tenellus*, Say, *Meteorus vulgaris*, Cress., and *Habrocytus* sp. When the parasite population is low, control may be effected with lead arsenate, but not sufficiently rapidly to prevent severe losses. It is desirable to find a spray giving immediate and satisfactory results. A dormant spray would be best, as the larvae feed on the under surface of the leaves and are difficult to reach, but in experiments a successful one was not found. A very thorough and timely application of summer oil (1 : 100) with nicotine sulphate (1 : 800), immediately after the eggs had hatched, was effective, but it is difficult to get over 85 per cent. control. A 1 per cent. summer oil spray alone was a very good ovicide. The introduction of Bordeaux mixture, lead arsenate or lime reduced the efficiency of both oil and oil-nicotine.

HUCKETT (H. C.). **Some Tests of Pyrethrum, Derris and Nicotine Mixtures against Cabbage Worms.**—*J. econ. Ent.* **29** no. 3 pp. 575–580. Menasha, Wis., June 1936.

Previous experiments on Long Island with non-arsenical insecticides for the control of Lepidopterous larvae attacking cabbage and cauliflower [*R.A.E.*, A **22** 407; **23** 528] showed that mixtures containing powdered derris or cubé [*Lonchocarpus*] gave satisfactory control of *Pieris rapae*, L., were not so effective against *Plusia* (*Autographa*) *brassicae*, Riley, and failed to affect *Ceramica* (*Mamestra*) *picta*, Harr.

All instars of the last-named seemed to be highly immune but in the case of *Plusia* only the older larvae. During the past 2 seasons further tests were carried out under insectary conditions with derris and other non-arsenical insecticides against these 3 species. The plan of procedure is described. The results with powdered derris root (4·5 per cent. rotenone, 16–18 per cent. total extractives) at strengths equivalent to 4, 3 and 2 lb. per 100 U.S. gals. water with a skim milk powder spreader confirmed those obtained previously. The highest concentration killed, in 96 hours, over 80 per cent. of the larvae of *Pieris*, 70 per cent. of those of *Plusia* and only 10 per cent. of those of *Ceramica*, although the larvae of *Pieris* were on the whole more advanced. The suspension apparently had little effect as a stomach poison. Against larvae of *Plusia*, a powder impregnated with an extract containing pyrethrins, applied as a contact insecticide in dust form at 0·2 and 0·1 per cent. pyrethrin content, gave 94·6 and 83·3 per cent. mortality in 48 hours as compared with 7·5 per cent. in controls, dusts containing ground pyrethrum flowers at 0·45, 0·27 and 0·18 per cent. pyrethrin content giving mortalities of 77·1, 64·7 and 52·8 per cent. The effect of the dust was more marked in the case of the smaller larvae, particularly in the case of the pyrethrum flowers. Against *Ceramica*, nicotine and pyrethrum preparations both gave promising results in 1934 when applied heavily to colonies of the larvae, but the cost of pyrethrum was high. In the insectary a heavy contact application of 40 per cent. nicotine sulphate in hydrated lime dusts (3 and 4 per cent. nicotine content) gave 80–94 per cent. control of earlier instar larvae. A lighter application on older larvae of *Plusia* was ineffective, giving only 4–10 per cent. control.

Goodhue (L. D.) & Fleming (W. E.). **Stickers for Derris applied as an insecticidal Spray.**—*J. econ. Ent.* **29** no. 3 pp. 580–583, 3 refs. Menasha, Wis., June 1936.

It has been found that foliage can be protected from the Japanese beetle [*Popillia japonica*, Newm.] by sprays containing powdered derris [*cf. R.A.E.*, A **22** 297], but because of the poor adhesion of the derris, the spray has to be renewed after every rain. In laboratory investigations begun in the autumn of 1934, 24 substances were tested as adhesives for derris. They included oils, waxes and resins emulsified with ammonium caseinate or triethanolamine caseinate, asphalt and latex obtained in emulsified form, and agar-agar and flour dispersed in water in the usual manner. The technique of the tests is described. The spray was applied in uniform quantities to glass plates or bean leaves, and after it had dried, the plates or leaves were subjected to falling drops of water in an amount equivalent to very heavy rain. The resulting loss of derris was determined. The leaves were used for testing the adhesives that were most promising on the plates, with the exception of asphalt emulsion, which was the most effective of all but was rejected because the black colour was objectionable. They received a fine spray containing 1 per cent. derris and 0·5 per cent. adhesive. The most effective adhesive was resin residue, which only allowed 5 per cent. of the derris to be washed off as compared with 92·5 per cent. when no adhesive was used. Resin residue is the material that remains in the stills after the distillation of resin. It is cheap, and does not injure foliage or decompose derris. The least viscous grade appeared to be the most suitable, as it is the most easily emulsified. The emulsion was prepared with 4 lb. casein, 45 lb. water, 12 oz. ammonium

hydroxide and 50 lb. resin residue. Of the other substances that reduced loss of derris satisfactorily, agar-agar was costly and difficult to prepare, latex decomposed rapidly in the sunlight, and the oils increased the rate of deterioration of derris in sunlight.

PEAIRS (L. M.). **Barium Carbonate for the Bean Beetle.**—*J. econ. Ent.* **29** no. 3 pp. 584–585. Menasha, Wis., June 1936.

Laboratory and field tests were carried out during 1934 and 1935 in West Virginia on the value of barium carbonate for the control of the Mexican bean beetle [*Epilachna varivestis*, Muls.]. The product used was a proprietary one (Baricide) in which were incorporated substances to promote adhesion and suspension. As no official statement has been made concerning barium residues, it is presumed that they are not objectionable, although barium carbonate is used in rat poison. In laboratory tests the insecticide killed adults and larvae of *Epilachna* rather slowly and showed varying degrees of toxicity to other Coleoptera. Larvae of several species of Lepidoptera were apparently unaffected by it either in the laboratory or the field. In no field test against *Epilachna*, however, did barium carbonate, except at low strengths, show results more than 10 per cent. below the best standard materials. Results were usually within 5 per cent. of those obtained with other materials. Its disadvantage is that it is expensive and difficult to apply, owing to the quantity required. The sprays contain 1–4 lb. in 4 U.S. gals. water, need constant agitation, and tend to clog the nozzles of the sprayer, and their adhesiveness is inferior to that of the standard materials. Used as a dust, it is applied without a carrier and is therefore very expensive, coverage and adhesiveness are poor, and the dust, being strongly hygroscopic, has to be dried after exposure to moist atmosphere before it can be used. Barium carbonate may be recommended only where cost and labour are unimportant and where poisonous residues are particularly objectionable.

WOLFENBARGER (D. O.). **Feeding and Utilization of Sucrose Solutions by Potato Flea Beetle and Fall Webworm. Feeding Insecticides to Flea Beetle.**—*J. econ. Ent.* **29** no. 3 pp. 586–589, 2 figs., 3 refs. Menasha, Wis., June 1936.

Insects with biting mouth-parts were fed on liquids through double 25-mesh muslin with apparent success. Adults of *Epitrix cucumeris*, Harr., and larvae of the Arctiid, *Hyphantria cunea*, Drury, were used. When fed by this method the beetles lived for averages of 36 days on sucrose solution (20 per cent.) and 10·9 days on distilled water, while starved beetles lived for 2·1 days. The toxicity of stomach poisons was tested by this method. The differences between the average length of life of beetles given lead arsenate, copper sulphate and calcium arsenate at 2, 4 and 2 lb. per 50 U.S. gals. water respectively and those given water were not great enough to be outside chance occurrence. Copper sulphate at 8 lb. to 50 U.S. gals. and barium fluosilicate at 2 lb. gave mortality nearly equal to that of the starved beetles. In other tests beetles sprayed with Bordeaux mixture alone and in combination with some common stomach poisons, or dusted with a mixture of calcium arsenate, copper sulphate and lime, lived

almost as long as those sprayed with water, calcium arsenate in Bordeaux spray alone giving a difference outside chance occurrence. Very young larvae of *H. cunea* confined in a jar containing an inverted vial of sucrose solution were observed to feed, and after 8 days 79·6 per cent. were alive, as compared with only 2·8 per cent. of larvae in an empty jar.

Moore (Warren). **Persistence of Toxicity of Nicotine-Bentonite on Apples.**—*J. econ. Ent.* **29** no. 3 pp. 590–594. Menasha, Wis., June 1936.

It has been shown that ultra-violet radiation causes destructive oxidation of nicotine, including nicotine fixed on bentonite. Experiments were therefore made in Virginia to find whether sunlight has a similar action. In two trials, 83 and 78 per cent. of the nicotine in thin films of nicotine-bentonite on the inside surface of quartz containers exposed to sunlight from February to March was recovered after 90 days. To determine biologically whether, under field conditions, fixed nicotine was destroyed by sunlight, the toxicity of the pink side of sprayed apples was compared over a period of time with that of the green side. Each of 3 trees received 6 cover sprays at intervals of 10 days from 9th May to 3rd July. The first tree was sprayed with 5 lb. bentonite and 1·1 lb. nicotine sulphate, the second with the same plus 1·7 lb. tannic acid, and the third with 3 lb. lead arsenate and 5 lb. lime, all in 100 U.S. gals. water with the addition of 3·5 oz. dry skim milk. One egg of *Cydia* (*Carpocapsa*) *pomonella*, L., was confined to each side of apples taken at different dates from these trees. The percentages of larvae injuring or entering the apples are shown in a table. Samples taken in June were almost invariably more toxic on the pink side, as the exposed parts had received more spray. Special efforts were then successfully made to secure a uniform coverage, and inspections showed that photochemical decomposition was a negligible factor in loss of toxicity of apples sprayed with the tank-mixed nicotine-bentonite, at least in humid regions. Comparison of the relative toxicity of the nicotine-bentonite and the lead arsenate sprays showed results in favour of the nicotine-bentonite as regards both injuries and entries, but the two sprays were not applied to the same variety. Nicotine-bentonite was still superior 6 weeks after the last spray was applied. In general the tannic acid increased the efficiency of the spray.

Fink (D. E.) & Haller (H. L.). **Relative Toxicity of some optically active and inactive Rotenone Derivatives to Culicine Mosquito Larvae.**—*J. econ. Ent.* **29** no. 3 pp. 594–598, 2 figs., 9 refs. Menasha, Wis., June 1936.

Although rotenone is regarded as probably the most important insecticidal constituent of derris extractives, it has been shown that other compounds of possibly equal toxicity are present. Tests of three of these [*cf. R.A.E.*, A **19** 102] have shown that deguelin is not sufficiently toxic to account for the effectiveness of derris extractives and that tephrosin and toxicarol are still less toxic. As isolated from derris extractives, these three substances are optically inactive, whereas rotenone is optically active. Recent experiments have shown

that deguelin is present in extractives in important quantities and, indirectly, that at least part of it is in optically active form. If evidence could be obtained that optically active deguelin and other derivatives of rotenone are more toxic than the corresponding inactive forms, the high toxicity of the constituents of derris extractives other than rotenone would become more readily understandable.

It has not been found possible to isolate the optically active form of deguelin nor the optically inactive form of rotenone, but both optically active and inactive forms of dihydrodeguelin and isorotenone have been made, and in the present experiments the relative toxicity of these forms was determined and compared with that of rotenone and deguelin, using the larvae of Culicine mosquitos as test insects. The chemical composition of the compounds tested is discussed. The results show that the optically active substances are more toxic than the corresponding inactive forms at all concentrations tested [*cf.* **24** 68]. If the optically active deguelin exceeds in toxicity the inactive form to the same extent as the active dihydro-derivative exceeds its inactive form, then the hitherto unaccountable toxicity of derris extractives may be attributed partly to optically active deguelin.

Acree, Jr. (F.), Schaffer (P. S.) & Haller (H. L.). **Constituents of Pyrethrum Flowers. III. The Pyrethrin Content of fresh Flowers.**—*J. econ. Ent.* **29** no. 3 pp. 601–605, 5 refs. Menasha, Wis., June 1936.

The following is the authors' summary: A study was made of pyrethrum flowers to determine whether the pyrethrins are present in the fresh flowers, and if so, to what extent they are affected by enzyme activity and moisture content in the process of drying. The results confirm those of Gnadinger and co-workers [*R.A.E.*, A **22** 30] in that the method of drying produces very little variation in the pyrethrin content of the flowers. It is shown that the pyrethrin I and pyrethrin II exist as such in the fresh pyrethrum flowers. Enzymes and moisture have a negligible effect on the synthesis or decomposition of the pyrethrins in the process of drying the flowers.

Hoyer (D. G.) & Leonard (M. D.). **Pyrethrin Content of Pyrethrum Flowers from various Sources.**—*J. econ. Ent.* **29** no. 3 pp. 605–606. Menasha, Wis., June 1936.

Lists are given showing the quantities of pyrethrum flowers imported into the United States from various countries in 1932, 1933 and 1934, and the percentages of pyrethrins contained in flowers produced in Kenya, Japan, Dalmatia, the United States, France, Brazil, Bulgaria and the Russian Union, which decrease in that order. All the flowers are *Chrysanthemum cinerariaefolium* except those grown in Russia, which are *C. roseum*. Of the principal sources of supply, Japan produces flowers with a pyrethrin content of 1 per cent. or twice as much as that of Dalmatian flowers. The flowers from Kenya, a comparatively new producer, contained 1·36 per cent. pyrethrins, whereas those from Russia contained only 0·23 per cent. Biological evaluations of toxicity made on house-flies in a Peet-Grady test chamber [*R.A.E.*, A **16** 677] agreed closely with the pyrethrin content.

Murphy (D. F.). **Insecticidal Activity of Aliphatic Thiocyanates III. Red Spiders and Mites.**—*J. econ. Ent.* **29** no. 3 pp. 606–611, 7 refs. Menasha, Wis., June 1936.

Since the appearance of the previous papers in this series [*R.A.E.*, A **20** 294; **21** 566], further data have been published on the value of thiocyanates as insecticides [**22** 697; **23** 320]. Research work in Pennsylvania over a period of 10 years has established the fact that B butoxy B′ thiocyanodiethylether (marketed as Lethane 420 and Lethane 440) [**23** 463] is of outstanding value against various insects.

In 1932-35 this thiocyanate was tested against *Tetranychus telarius*, L., on Jerusalem cherry [*Solanum pseudocapsicum*] and carnations in the laboratory and on carnations in the greenhouse, and against *Paratetranychus pilosus*, C. & F., in apple orchards. In the laboratory tests commercial pyrethrum, derris and selenium sprays were used for comparison. B butoxy B′ thiocyanodiethylether at 1 : 600 and 1 : 800 with a spreader and emulsified with a sulphonated oil gave over 95 per cent. kill and did not harm the plants, but at 1 : 1,000 was much less effective. Selenium gave 95 per cent. kill, but derris and pyrethrum were very much inferior. In the greenhouse tests, Lethane 420 at 1 : 400 with spreader killed 90–95 per cent. Preliminary tests indicate that the thiocyanate at 1 : 800 will destroy about 70 per cent. of the eggs. As a fungicide was necessary in the apple orchard, B butoxy B′ thiocyanodiethylether, emulsified with sulphonated oil, was combined with lime-sulphur at summer strength or with flotation sulphur, 10 lb. to 100 U.S. gals. A spreader was used in each case. Lime-sulphur and flotation sulphur alone were used for comparison, but failed to give practical control of the mite. Unsprayed check trees had an average of 25·9 live mites per leaf. On the day after spraying, the thiocyanate at 1 : 800 with lime-sulphur had reduced this number to 0·77, at 1 : 1,600 and 1 : 2,400 combined with flotation sulphur it had reduced it to just over 2. At 1 : 2400 with lime-sulphur it reduced the average population to 0·6 in 2 days but after 2 weeks the population had risen again to 8.

Cupples (H. L.), Yust (H. R.) & Hiley (J.). **Tests of possible Substitutes for Hydrocyanic Acid in Fumigation of California Red Scale.**—*J. econ. Ent.* **29** no. 3 pp. 611–618, 3 refs. Menasha, Wis., June 1936.

An account is given of tests on *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask. (California red scale) on lemons with more than 300 compounds, in an effort to find fumigants better than, or capable of improving the action of, hydrocyanic acid gas.

The following is largely the authors' summary: Comparatively few of the compounds tested showed a substantial toxic action to *A. aurantii*, and no compound that was not toxic to the scale was found to be markedly effective with hydrocyanic acid gas. Ethylene oxide is moderately toxic, but concentrations sufficient to kill the scale will injure the foliage of *Citrus*. Chloropicrin is toxic to the scale, but also readily scorches the fruit. Practically a complete kill of scale was obtained with hydrogen sulphide at a dosage of 25 per cent. by volume for 25 minutes, but although no tests on foliage have been made with this compound, it is believed that such a dosage would severely injure *Citrus* vegetation. The same is probably true of many of the

compounds that gave good kills. Comparison with tests on Coccinellids [*R.A.E.*, A **22** 90] showed that the gases had not the same effect on *A. aurantii*. A 10 per cent. concentration of carbon dioxide increased the toxicity of hydrocyanic acid gas to the latter. Various thiocyanates and isothiocyanates were toxic to the red scale at moderate concentrations, the former seeming superior because less injurious to *Citrus* fruit and foliage. Both methyl [**24** 537] and ethyl thiocyanates showed a high toxicity to the scale, with the methyl compound having the advantage of a lower boiling point. Methyl thiocyanate and hydrocyanic acid gas appeared about equally effective, molecule for molecule, methyl thiocyanate having the superior efficiency in obtaining a complete kill. Because of its lower molecular weight, however, hydrocyanic acid was superior on a weight basis. In some tests on *Citrus* nursery stock, methyl thiocyanate proved inferior to hydrocyanic acid because of greater injury to foliage. There was no evidence that the toxicity of the thiocyanates increased with the molecular weight, or boiling point; in fact the lower members of the series seemed to be the more effective. It is of interest that the substitution of an organic radical for the hydrogen atom in HCN produces a compound substantially not toxic to the scale. However, if an atom of sulphur is then introduced into the organic cyanide (nitrile) to form a thiocyanate, a very toxic compound is again obtained.

YIP (J. S.). **Insect Damage to Seeds of** *Cracca virginiana* **L.**—*J. econ. Ent.* **29** no. 3 pp. 622–629, 2 figs., 10 refs. Menasha, Wis., June 1936.

It was observed that damage had been done by insects to the seeds of *Tephrosia* (*Cracca*) *virginiana* (devil's shoe-string), a leguminous plant indigenous to the United States, which contains insecticidal substances [*R.A.E.*, A **19** 549; **23** 649] and is easily propagated by seed. It is thought possible that the failure of plants in some localities to produce seed pods was due to insect injury to the flower, as there was evidence of blooming. Collections of pods were made from 9 localities in 3 States and unopened pods were examined. It is probable that damaged pods opened less readily than undamaged ones. This would make the infestation, which was heavy in pods from all 9 districts, appear greater than was actually the case. The 874 pods examined contained only 36·3 per cent of the potential number of normal seeds. The insects found in the pods were the weevil, *Apion segnipes*, Say, *Bruchus* (*Acanthoscelides*) *obsoletus*, Say, the Pyralid, *Ulophora tephrosiella*, Dyar, an undetermined Geometrid, and the Hymenopterous parasites, *Eurytoma tylodermatis*, Ashm., *Eupelmus cyaniceps* var. *amicus*, Gir., and a Braconid, *Heterospilus* sp. The adults of *Apion* seemed to be much more abundant than those of the Bruchid, and the larvae, like those of the Pyralid, always appear much earlier and feed on the seed when it is in the earliest stages of development. According to J. C. Bridwell, if the population of these two early feeders were greatly reduced, the damage being done by *Bruchus* would no doubt become more evident. The weevil passes all its immature stages between the valves of the pod, consuming all or nearly all the seeds. The Bruchid usually pupates in the seed, leaving nothing but an empty seed coat when it emerges. Like *Apion* it depends upon the dehiscence of the pod for release. *U. tephrosiella* was found in all lots of pods examined. The

larvae damage the entire contents of the pod but probably pupate elsewhere. The Geometrid occurred only once, and the adult, cocoon and larval stages of *Heterospilus* in seeds from one locality only, its host being probably *Ulophora*. The other two parasites, the distinctive characters of which are described, were found in very small numbers in most of the localities, but their hosts are not known.

COLMAN (W.). **Comparison of Tetrahydronaphthalene and Ethylene Dichloride-Carbon Tetrachloride Mixture as Fumigants against Clothes Moth Larvae.**—*J. econ. Ent.* **29** no. 3 pp. 629–630, 3 refs. Menasha, Wis., June 1936.

A mixture of 75 per cent. by volume of ethylene dichloride and 25 per cent. carbon tetrachloride was compared with tetrahydronaphthalene [*R.A.E.*, A **22** 650] against larvae of *Tineola biselliella*, Humm. (webbing clothes moth) under conditions approaching those of actual use. The tests were conducted simultaneously with equal volumes of the 2 fumigants under identical conditions on 300 larvae reared on sterilised raw sheep's wool and devitalised powdered brewers' yeast [**21** 78], and placed in cages previously described [**20** 698] 48 hours before the beginning of the test. One cabinet with a capacity of 71 cu. ft. was used for each fumigant and one as a control. The fumigants were absorbed in 3 sq. yards of canvas, which was hung near the top of the cabinet. After fumigation the larvae were transferred to the control cabinet for one week. Tetrahydronaphthalene was shown to be the more effective fumigant. It gave 100 per cent. mortality in all tests when the quantity used was 100 cc. and in some when it was 50 cc., whereas the mixture did so in all the tests when 200 cc. was used and in none of the others.

BARBER (G. W.). **Efficiency of *Trichogramma minutum* Riley, in Relation to Population Density of its Host.**—*J. econ. Ent.* **29** no. 3 p. 631. Menasha, Wis., June 1936.

Three instances are recorded from two areas in Georgia of very high rates of parasitism by *Trichogramma minutum*, Riley, of eggs of *Heliothis armigera*, Hb. (*obsoleta*, F.) on maize and soy beans and of *Anticarsia gemmatalis*, Hb., on soy beans. That on maize occurred in early summer and those on soy beans in autumn. In all three cases the host eggs were particularly abundant. As *T. minutum* appears to find host eggs only by exploration, the extent of oviposition tends to depend on their abundance, and if they are scarce or scattered the parasite population may decrease. Only when the population of the hosts becomes unusually great, does the parasite occur in sufficient numbers to effect control. It is thought that this is the explanation of its high efficiency in the examples given.

WOGLUM (R. S.) & LEWIS (H. C.). **Nitrogen Trichloride as a Fumigant.**—*J. econ. Ent.* **29** no. 3 pp. 631–632. Menasha, Wis., June 1936.

Nitrogen trichloride has been found to kill spores of certain decay organisms, including species of *Penicillium*, and is used by some orange-packing houses in California to retard decay. As treatment is required to eliminate *Hercothrips fasciatus*, Perg. (bean thrips) from certain *Citrus* fruits for export, tests were carried out with oranges to determine

the effect of nitrogen trichloride on the thrips. They indicated that a complete kill is only obtained with concentrations that are injurious to oranges.

STEINER (H. M.). **New Nymphal-adult Parasite of White Apple Leafhopper.**—*J. econ. Ent.* **29** no. 3 pp. 632–633. Menasha, Wis., June 1936.

A study of the natural enemies of *Typhlocyba pomaria*, McAtee, on apple in eastern New York during 1933–35 has shown that, in many orchards, a recently described Dryinid, *Aphelopus typhlocybae*, Mues. [*R.A.E.*, A **24** 299], is second in importance only to the Mymarid egg parasite, *Anagrus armatus* var. *nigriventris*, Gir. *Aphelopus*, like its host, has two generations a year. The adults, which are very active, emerge from cocoons in the soil when, or just before, the leafhopper nymphs hatch, and are abundant in late May and again in August. They oviposit in nymphs of early instars, but the pouch enclosing the parasite larva only becomes visible externally 1–3 weeks after the leafhopper reaches the adult stage. Leafhoppers bearing fully developed larvae are most abundant on low hanging branches. Although as many as 5 immature larvae have been found in a single host, no more than one reaches maturity. It matures in 3–7 weeks after the host becomes adult, and then leaves it, drops to the ground and spins a cocoon just below the surface of the soil. The greatest numbers of larvae drop during the first week of July and the first half of October. Thousands of dead leafhoppers have been found clinging to foliage for several weeks after they have been deserted by the parasite larvae. The latter suffer high mortality during early July if they drop on to unshaded soil. Parasitism is generally highest on trees with many low hanging branches, and lower in cultivated orchards than in sod orchards, except where cultivation is practised only when the parasites are in the host. The highest degree of parasitism observed was 78 per cent. of second-brood leafhoppers in an orchard cultivated in June only. Parasitism of first-brood leafhoppers reached 74 per cent. in an undisturbed sod orchard, but in cultivated orchards parasitism of both broods ranged from 1 to 21 per cent.

T. pomaria is the only known host, but an attempt has been made to establish *A. typhlocybae* against the yellow apple leafhopper, *T. froggatti*, Baker (*australis*, Frogg.), in New Zealand.

HEMING (W. E.). **Enemies of the Mexican Mealybug,** *Phenacoccus gossypii* **(T. & Ckll.).**—*J. econ. Ent.* **29** no. 3 p. 633. Menasha, Wis., June 1936.

Natural enemies observed attacking *Phenacoccus gossypii*, Tns. & Ckll., in an insectary in New York State in 1935 included larvae of *Chrysopa oculata*, Say, and the Syrphid, *Mesogramma* (*Toxomerus*) *marginata*, Say, and also the parasite, *Tanaomastix* (*Leptomastidea*) *abnormis*, Gir., which was by far the most abundant and markedly reduced the mealybug population on *Coleus*. One nearly mature larva of *C. oculata* was seen to feed on 9 nymphs and adults in an hour.

BISSELL (T. L.). **Insects infesting Cotton Seed.**—*J. econ. Ent.* **29** no. 3 p. 634. Menasha, Wis., June 1936.

Larvae of *Pyroderces rileyi*, Wlsm., and adults of *Tribolium castaneum*, Hbst. (*ferrugineum*, F.) were found in Georgia in screenings from

cotton seed of the 1935 crop, but none of the seed was observed to be injured. Larvae and adults of *Carpophilus dimidiatus*, F., and adults of *Laemophloeus minutus*, Ol., and *T. castaneum* were seen in cotton seed that had been stored at least one and possibly two years, and of which 1·9 per cent. had been infested. *C. dimidiatus* was the most common, and larvae and adults were found in a few seeds, but it is not certain whether they were the first insects to attack the seeds. Usually the whole kernels of injured seeds were reduced to frass of a bright yellow colour.

HOFFMANN (W. E.). **Observations on a Hesperid Leaf-roller and a Lace-bug, two Pests of Banana in Kwangtung.**—*Lingnan Sci. J.* **14** no. 4 pp. 639–649, 5 pls., 15 refs. Canton, 4th October 1935.

Descriptions are given of all stages of the Hesperiid, *Erionota thrax*, L., and the eggs, fifth-instar nymph and adult of the Tingid, *Stephanitis typicus*, Dist., which are pests of banana in Kwangtung. The larvae of *E. thrax*, which roll the leaves, were exceptionally abundant during 1935. The eggs are laid on the leaves, singly or in groups of up to 20. The egg, larval and pupal stages last approximately 5, 23–25, and 10 days, respectively, and at least two and possibly more generations occur in the year. Eggs have been found in Canton in late May, by mid-July all stages are abundant on the leaves, and larvae have been taken in late August. Many of the eggs collected in late July were parasitised by unidentified Chalcidoids.

During 1935, *Stephanitis typicus* was observed for the first time in the Canton district. Up to 60 eggs were inserted in the tissue of the underside of the leaf, and the nymphs and adults remained together near this spot. The nymphal period is known to be relatively short, and there are probably several generations a year, the second of which is completed by the middle of July. On an experimental plot, an atomised spray of pyrethrum in oil gave satisfactory control. Infestation of bananas by *S. typicus* was more severe in Kwangsi than in Kwangtung; infestation by *E. thrax* was as severe in west Kwangsi, but less so in the east. At several places in Kwangsi, a Capsid was found attacking the nymphs, but not the adults, of *S. typicus*.

HOFFMANN (W. E.). **A novel Native Method of Controlling June-beetles.**—*Lingnan Sci. J.* **14** no. 4 pp. 689–690, 1 pl. Canton, 4th October 1935.

In the south of Kwangtung, the larvae of a cockchafer that attacks *Euphoria longana* are trapped in balls of straw and duck manure, 15–18 ins. in diameter, placed in the trees. The beetles oviposit in the balls, which are destroyed periodically.

DRAKE (C. J.) & HSIUNG (Ta Shih). **An undescribed Tingitid from the Chinese Ash (Hemiptera).**—*Lingnan Sci. J.* **15** no. 2 pp. 287–288. Canton, 20th June 1936.

Dictyonota mitoris, sp. n., is described from Chinese ash in Tientsin. *Stephanitis nashi*, Esaki & Takeya, which infests the leaves of pear and was originally described from Japan, is recorded from Changsha and Canton.

Hoffmann (W. E.) *Alucita niveodactyla* **Pag. (Microlepidoptera : Pterophoridae), a Pest of Sweet Potatoes in Kwangtung.**—*Lingnan Sci. J.* **15** no. 2 pp. 311–312, 3 figs. Canton, 20th June 1936.

Alucita niveodactyla, Pag., all stages of which are briefly described, is responsible for a considerable proportion of the damage caused by caterpillars to sweet potato during the winter months in the Canton area. The larvae mature in about 3 weeks and pupate on the leaves of the food-plant, on rubbish or on the ground. The eggs are laid on the lower surfaces of the leaves.

As the larvae are gregarious and migrate to a new leaf only when the first is practically destroyed, hand-picking is an effective method of control. The adults, which are conspicuous and inactive during the daytime, may be caught with a net.

Chin (Shing-mu). **Notes on** *Ceresium sinicum* **White (Col., Cerambycidae).** [*In Chinese*].—*Ent. & Phytopath.* **3** no. 34 pp. 684–689, 6 figs. Hangchow, 1935. (Abstr. in *Lingnan Sci. J.* **15** no. 2 p. 327. Canton, 20th June 1936.)

An account is given of the bionomics of the Cerambycid, *Ceresium sinicum*, White, which infests mulberry in China and Japan, and the stages are described. The eggs are laid in late May, and hatch in about 11 days. The larvae are full-grown in September, when they enter hibernation [*cf. R.A.E.*, A **20** 169], and pupate early in the following April. The adults emerge in mid-May and live for about 3 weeks.

Ku (T. H.). **An Investigation of the Pebrine disease** (*Nosema bombycis*) **in Mulberry Yellow Worm** (*Rondotia menciana* **Moore).** [*In Chinese.*]—*J. agric. Ass. China* no. 142–143, pp. 214–215. 1935. (Abstr. in *Lingnan Sci. J.* **15** no. 2 p. 335. Canton, 20th June 1936.)

As over 20 per cent. of the larvae of *Rondotia menciana*, Moore, examined in Chekiang were infected with pebrine disease, destroying them on mulberry trees might reduce the infection of silkworms [*Bombyx mori*, L.].

Liu (Kwo-si). **Notes on the Life-history of** *Agrotis ypsilon* **Rott. in Hangchow (Lep.: Noctuidae).** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 121–125, 6 figs. Hangchow, October 1935. (Abstr. in *Lingnan Sci. J.* **15** no. 2 p. 338. Canton, 20th June 1936.)

Agrotis ypsilon, Hfn., attacks a large number of economic plants in central China and the provinces along the south-eastern coast, and is particularly injurious to cotton seedlings. The female lays upwards of 1,500 eggs. The life-cycle occupies about a month, and four generations occur in a year, the adults emerging in mid-April, early June, late July and early September. Hibernation takes place in the larval or pupal stage.

Liu (Kwo-si) & Hwang (Chung-chiang). **Biology of a Cotton Cutworm, *Agrotis* sp. (Lep. ; Noctuidae) in Hangchow.** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 241–244, 1 fig. Hangchow, October 1935. (Abstr. in *Lingnan Sci. J.* **15** no. 2 p. 339. Canton, 20th June 1936.)

In China, the principal food-plants of this unidentified species of *Agrotis*, all stages of which are described, are maize and *Medicago denticulata* ; it has also been found to attack 15 species of winter crops, and damages cotton from late autumn to late spring or early summer. Eggs are laid in mid-November, and hatch in 32 days. The larvae aestivate in the ground from mid-May to September. Pupation occurs during September, and the adults emerge in October. Females may lay over 1,400 eggs.

Liu (Kwo-si). **Observations on the Death Rate of *Chondacris rosea* DeGeer, due to *Empusa* sp.** [*In Chinese*].—*Ent. & Phytopath.* **3** no. 36 pp. 726–727, 1 fig. Hangchow, 1935. (Abstr. in *Lingnan Sci. J.* **15** no. 2 p. 339. Canton, 20th June 1936.)

In late August and September 1935, adults and almost mature nymphs of *Chondacris rosea*, DeG., were attacked by *Empusa* sp. The symptoms of the disease are described. The death rate varied from 82 to 100 per cent., and in an area of 36,320 sq. ft. there were 4,996 dead and 347 living grasshoppers.

Husain (M. A.) & Baweja (K. D.). **Studies on *Schistocerca gregaria* Forsk. IV. Colour Changes and Sexual Behaviour in Desexualised *Schistocerca gregaria* Adults.**—*Indian J. agric. Sci.* **6** pt. 3 pp. 586–590, 9 refs. Delhi, June 1936.

Observations on male and female adults of *Schistocerca gregaria*, Forsk., that had had their gonads removed showed that they lived as long as normal ones and that the yellow colouration, which has always been taken to indicate sexual maturation, develops in both sexes in the absence of the gonads.

Husain (M. A.) & Mathur (C. B.). **Studies on *Schistocerca gregaria* Forsk. V. Pigmentation and Physical Exertion.**—*Indian J. agric. Sci.* **6** pt. 3 pp. 591–623, 3 pls., 7 refs. Delhi, June 1936.

The hypothesis that the black pigmentation characteristic of hoppers of the gregarious phase of *Schistocerca gregaria*, Forsk., is produced by muscular activity was confirmed by experiments in which the ph. *gregaria* colouration was assumed by ph. *solitaria* hoppers that were forced to crawl a certain distance every day in revolving wire-gauze drums and cylindrical cages that rotated vertically at intervals.

The ph. *gregaria* colouration was also obtained by crowding individual ph. *solitaria* hoppers with the hoppers of *Poecilocerus pictus*, F., and the adults of *Chrotogonus* sp. The ph. *solitaria* colouration was, however, retained when the hoppers were crowded with the adults of *Gryllulus* (*Gryllus*) *domesticus*, L., which are active by night.

Husain (M. A.) & Ahmad (T.). **Studies on** *Schistocerca gregaria* **Forsk. VI. Influence of Temperature on the Intensity and Extent of Black Pattern in the Desert Locust Hoppers bred crowded.**—*Indian J. agric. Sci.* **6** pt. 3 pp. 624–664, 5 col. pls., 5 refs. Delhi, June 1936.

Phasis *transiens* and phasis *gregaria* hoppers of *Schistocerca gregaria*, Forsk., were bred under crowded conditions at constant temperatures ranging from 24 to 44°C. [75·2–111·2°F.]. The black colour was most intense and the black pattern most extensive in hoppers bred at 24°C. At 33°C. [91·4°F.], the pigmentation was generally reduced, and the body colour was yellowish in the second and third and greenish in the subsequent instars. The black pattern was much reduced in the hoppers bred at 40°C. [104°F.] ; in those reared at 44°C. it was almost absent, and the body colour was uniformly yellowish-white. Detailed descriptions of the colouration of all the instars of hoppers bred at different temperatures are included.

Husain (M. A.) & Bhatia (D. R.). **Studies on** *Schistocerca gregaria* **Forsk. VII. Factors determining the Movement of the Vermiform Larvae.**—*Indian J. agric. Sci.* **6** pt. 3 pp. 665–671, 4 figs., 1 ref. Delhi, June 1936.

A study was made of the factors determining the upward movement of the vermiform larvae of *Schistocerca gregaria*, Forsk., hatching below the surface of the soil. It was found that it was not due to phototropism, as it took place in a normal manner in a photographic dark room. The factor concerned was pressure and not gravity, for larvae crawled vertically downwards through the froth plug when the test tube containing the egg-pod was inverted, and horizontally, in all directions, when the egg-cluster was so placed that the pressure of sand was uniform on all sides.

Steiner (P.). **Beiträge zur Kenntnis der Schädlingsfauna Kleinasiens III.** *Laphygma exigua* **Hb., ein Grossschädling der Zuckerrübe in Anatolien.** [Contributions to the Knowledge of the Pests in Asia Minor III. *L. exigua* a major Pest of Sugar-beet in Anatolia.] —*Z. angew. Ent.* **23** no. 2 pp. 177–222, 11 figs., 8 refs. Berlin, July 1936.

A detailed account is given of studies in 1933–35 on the bionomics of *Laphygma exigua*, Hb., in Anatolia, where it is a very important pest of sugar-beet, its recorded distribution and food-plants are reviewed, and all stages, including each of the 5 larval instars, are described.

The adults emerged and paired by night, ovipositing on the food-plant. The number of eggs laid averaged 330–367. At 20–24°C. [68–75·2°F.] the pre-oviposition period averaged 2 days, and the oviposition period 7, 47 per cent. of the eggs being laid on the first 2 days. The egg-stage lasted about 3 days at an average temperature of 23·2°C. [73·76°F.], and 6 at 19·8°C. [67·64°F.]. The larval stage lasted 16·4 days at 20–22·5°C. [68–72·5°F.] and 24·7 days at 16·3–18·8°C. [61·34–65·84°F.]. In feeding experiments 2,956–3,666 sq. mm. of beet leaf was eaten by a larva during total development, and more than 80 per cent. of this in the fifth instar. The larvae appeared to be most sensitive to low temperatures in the first and fifth instars,

particularly the former. The prepupal stage lasted from 1 day at 30°C. [86°F.] to 2·9 days at 17·7°C. [63·86°F.], and the pupal stage of females from 6 days at 30°C. to 18 days at 15·4°C. [59·72°F.], that of males requiring a little longer.

From special studies on the effects of temperature, the thresholds of development of the eggs, larvae and pupae were calculated to be 13·9, 11·43 and 12·5°C. [57·02, 52·57 and 54·5°F.] and the thermal constants 34·2, 168·3 and 112·35 day-degrees C. [93·56, 302·94, and 202·23 F.]. The threshold for the eggs proved too high; it was probably near 12°C. [53·6°F.] in reality. Over 95 per cent. of the eggs hatched at all temperatures between 13·1 and 38·7°C. [55·58–101·66°F.], and they were practically unaffected by variations in humidity. High humidity increased the duration of the pupal stage and dryness reduced it. The average monthly temperatures for May, June, July and August in 1929-34 in the Usak region were 14·8°C. [58·64°F.], 20·1°C. [68·18°F.], 24·1°C. [75·38°F.], and 23·5°C. [74·3°F.]. It is therefore only in June-August that a rapid succession of generations occurs. As a rule four generations a year may be expected, of which the second and third may be dangerous.

The effects of climate and parasitism on outbreaks are discussed in detail. The hibernating pupae were not affected by heavy rainfall or low soil temperature in winter. The outbreak years (1932 and 1935) were characterised by a higher temperature and lower rainfall from the time of the first adult flight until the development of the third generation. Parasitism amounted to 22·1 per cent. of the second generation in 1933, a normal year without a mass increase. In 1935 very few larvae were parasitised until July, when the third generation was present, but 50 per cent. of the fourth-generation larvae were parasitised in August. Tachinids accounted for only 6·2 per cent. of the total parasitism between 10th and 30th August; the effective parasite was almost exclusively *Euplectrus bicolor*, Swed. Many of the non-parasitised larvae were killed by disease, and it appeared certain that the fifth generation would be small and would be completely controlled by parasites emerging from the fourth. The parasites reared from the larvae or pupae during the whole period of the work were *Euplectrus bicolor*, *Cremastus decoratus*, Grav., *Apenteles spurius*, Wesm., *Meteorus* sp., *M. scutellator*, Nees, *Microplitis* sp., *Anilastus ruficinctus*, Grav., *Rhogas testaceus*, Spin., *R. pallidator*, Thnb., *Tachina rustica*, Mg., *T. fallax*, Mg., *Sturmia inconspicua*, Mg., *Microphthalma disjuncta*, Wied., *Echinomyia magnicornis*, Zett., and *Voria ruralis*, Fall. Notes on important characters and biology are given for a few of these species. *E. bicolor* oviposits on the fourth-instar larvae and sometimes on those of the third instar. From 2 to 22 eggs have been counted on a host. Apparently several females may oviposit on one host, but only the eggs first laid develop. At about 20°C., the egg, larval, prepupal and pupal stages lasted 5-6, 7–8, 2 and 8 days, respectively.

Of a number of insecticides tested against the larvae, sprays containing Urania green, and lead and calcium arsenate proved toxic in that order, whilst dusts containing calcium arsenate were much less effective. When the three arsenical sprays were applied in field tests in 1935, each at a concentration of 4 lb. to 100 gals., that containing Urania green, to which lime and molasses had been added, was by far the most effective and caused an average reduction of infestation of 71·6 per cent.

Klemm (M.). **Der gegenwärtige Stand der Frage über die Schädlichkeit des Apfelblütenstechers (*Anthonomus pomorum* L.).** [The present Position of the Question of the Harmfulness of the Apple Blossom Weevil, *A. pomorum*.]—*Z. angew. Ent.* **23** no. 2 pp. 223–264, 31 figs., 39 refs. Berlin, July 1936.

From a detailed discussion of observations and statistics in Germany during 1925–34, the author confirms his view that the apple crop is not reduced as a result of infestation by *Anthonomus pomorum*, L. [*cf. R.A.E.*, A **20** 342, etc.].

Mahdihassan (S.). **Predisposing Factors and Infection by Lac and other Scale Insects.**—*Z. angew. Ent.* **23** no. 2 pp. 265–280, 23 refs. Berlin, July 1936.

The following is the author's summary : The infection by lac insects implies a special condition of some special trees ; there are biological or constitutional factors of predisposition, which are constant ; there are physiological factors of predisposition which are external and variable in nature. The latter alone are considered here. Gum secretion, a diseased condition of the host, brought about by bacterial infection, is the right precursor of lac infection. It suggests that the lac insect feeds on gum, and this has been confirmed by showing the symbiote of the insect to thrive on gum in preference to glucose, which is normally present. Forest fires, frost and other dessicating agencies, bad for plant growth and sylviculture, are actually those under which lac cultivation has been thriving. They should be looked upon as nature's inducing agents for the plant to act as a better host of the lac insect and should be controlled rather than avoided. Views of other observers have been offered to prove that the nature of insect food is mostly responsible for increasing their population and unhealthy trees, losing their immunity, would be the more liable to attack by scale insects. In 1909 there was a climax of reproductive activity among Coccids in India, Egypt and America. The initial causal factor common among them all can only be climatic, on account of the wide distribution of the insects which have contemporaneously responded to such a cause.

Eckstein (K.). **Holzzerstörende Bockkäferlarven. *Ergates faber* L., der Mulmbock, *Leptura rubra* L., der Rothalsbock und *Hylotrupes bajulus* L., der Hausbock.** [Wood destroying Longicorn Larvae. *E. faber*, *L. rubra* and *H. bajulus*.]—*Z. angew. Ent.* **23** no. 2 pp. 281–293, 10 figs., 3 pp. refs. Berlin, July 1936.

In Germany, the Prionid, *Ergates faber*, L., occurs in the lower part of telegraph posts. Since only one or very rarely two larvae are found in a section of a post, it appears that the eggs are laid singly and not in wood in which oviposition has already occurred. In posts made of pine, the sapwood is completely destroyed, but the heartwood is very rarely attacked and the impregnated outer layer never. In spruce the outer layer is uninjured, but the entire interior is destroyed. The larval excreta are cylindrical. In the summer of 1932, adults of the Cerambycid, *Leptura rubra*, L., were recorded for the first time as having emerged from sections of telegraph posts, and in November 1935 two dead adults and some larvae up to 30 mm. long were obtained. They occurred in the parts of the posts that had

been below ground. Characters differentiating the larvae from those of *Hylotrupes bajulus*, L., are given. The excreta are spherical. The larvae of *H. bajulus* attack posts of both pine and spruce, feeding in all parts of the latter except the impregnated outer layer. The excreta are cylindrical, but in time divide into two approximately spherical parts. In a breeding experiment larvae lived for 4, 6 and over 10 years. There was considerable larval mortality.

Sokolov (N. P.). **Der Einfluss von Temperatur und farbiger Beleuchtung auf Entwicklung und morphologische Eigenschaften der Blattlaus *Lipaphis eresimi* Kalt.** [The Influence of Temperature and coloured Illumination on the Development and morphological Characters of the Leaf Aphid, *L. eresimi*.]—*Z. angew. Ent.* **23** no. 2 pp. 294–302, 10 refs. Berlin, July 1936.

An account is given of experiments in Tashkent to ascertain the effect of temperature and coloured light on development and morphology of *Lipaphis erysimi*, Kalt., reproducing parthenogenetically on chrysanthemum. Thermostats were used for the temperature experiments and cylinders of green and blue celluloid, which enclosed the plants, for the light experiments. The measurements of the body and various external parts of it indicated a decrease and a greater variation in the dimensions of Aphids kept at high temperatures. At 25°C. [77°F.] the usual green colour became whitish. Winged forms were produced at 20°C. [68°F.] and, in larger numbers, at room temperature (15·5–30°C. [59·9–86°F.]), but not at 25°C., so that the cause of their production could not be ascertained. Fertility was investigated by keeping adults that were the progeny of a given female in batches of 5 at various temperatures. The average number of larvae born per day were 26·5 at 25°C., 12·3 at 20°C. and 5·5 at room temperature (15·5–30°C.). In all series the highest larval production in 24 hours was at 25°C. The Aphids could not withstand a constant temperature higher than this. Coloured light reduced the measurements of the Aphids to some extent, but not so much as high temperature.

Kunike (G.). **Beiträge zur Lebensweise und Bekämpfung des Kornkäfers, *Calandra granaria* L. (Curculionidae).** [Contributions to the Life-history and Control of *C. granaria*.]—*Z. angew. Ent.* **23** no. 2 pp. 303–326, 16 figs. Berlin, July 1936.

This paper comprises records of original observations in Germany on *Calandra granaria*, L., and a survey of measures for its control in stored grain. All stages are described. At 24°C. [75·2°F.] adults survived for a year. Great variations were observed in the duration of development from egg to adult at a given temperature, some individuals from a single batch of eggs requiring more than twice as long as others. In the laboratory, 4–5 generations a year were possible, and 2 can be expected in grain stores in Germany, or even 3 in years with early and continued warmth. The egg is laid inside a grain and sealed with a fluid that sets hard. The number of eggs laid depended on temperature ; none was laid above 33°C. [91·4°F.] or below 12°C. [53·6°F.]. From laboratory experiments, the results of which are tabulated, it appeared that at 26°C. [78·8°F.] a female would produce an average of over 200 eggs, but an

experiment conducted in a grain store on similar lines showed an average of only 25 between 23rd April and 31st October 1935. Differences were observed in tests with various grains, so that if the progeny for wheat is taken as 100, it is 80 for rye, 86 for barley and 8·5 for oats. Only an approximate estimate of the rate of increase can be made from laboratory experiments ; most figures in the literature are too high.

Investigations suggested the division of food into 4 groups. Feeding and reproduction occurred in wheat, rye, oats, barley, maize, rice, acorns and buckwheat. The weevils fed but did not reproduce in flour, bran and groats, and fed but soon died in peas, beans, lupins, ground nuts and almonds. They did not feed in cacao beans, unroasted coffee and unhusked rice. At 4°C. [39·2°F.] some weevils were alive after immersion in water for 45 days, their own bodies supplying the oxygen required. Low temperatures were not harmful if they were produced naturally and gradually in autumn.

STEER (W.). **Observations on Codlin Moth** (*Cydia pomonella* **L.**) **in 1935.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 186–190, 2 figs, 3 refs. East Malling, Kent, May 1936.

An account is given of observations made on *Cydia pomonella*, L., in Kent during 1935. Cage experiments showed that moths emerged from 28th May till late July, 93 per cent. of them during June. Eggs were laid on fruits and foliage from June to early August, particularly in late June and early July. Larvae began to attack the fruit at the end of June, almost always entering pears through the eye and apples at the side. Fully fed larvae were leaving the apples from late July till the end of September, most of them doing so in mid-August. They began to leave the pears rather later than the apples. Of numbers of larvae collected and transferred to cages only one transformed (the moth emerging on 27th August), and observations in orchards and on harvested fruit showed that there was no second generation in 1935. Sprays of 4 lb. lead arsenate with 1 lb. Lethalate wetting preparation, 2 lb. derris (3·6 per cent. rotenone content) with 5 lb. soap, and ½ lb. nicotine with 5 lb. soap, each per 100 gals. water, were tested on pears. Each spray was applied to 4 trees chosen at random from a row of 16 on 10th July when hatching was in progress. All the fruits, including windfalls, were examined when ripe ; lead arsenate reduced the percentage of damaged fruits from 13·7 (on the 4 unsprayed trees) to 2·8 but 11·4 and 8·8 per cent. of the fruits were damaged after spraying with derris and nicotine respectively. Less than 0·001 grains arsenic per lb. fruit remained at harvest. Sprays for *C. pomonella* on apples should be applied as late as possible, since the deposit should be maintained on the side of the fruit as it increases in size.

MOORE (M. H.) & MONTGOMERY (H. B. S.). **A Field Spraying Trial of combined Fungicide-contact-insecticide Sprays in 1935.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 191–197, 7 refs. East Malling, Kent, May 1936.

As a result of severe frost in May, spraying tests with lime-sulphur in combination with contact insecticides on apples in Kent afforded no data of value as regards control of insects. However, three applications of each spray, at pink-bud, petal-fall and three weeks after, all gave good control of red spider [*Paratetranychus pilosus*, C. & F.], while the

leaves of unsprayed trees were severely infested. No evidence was forthcoming that the addition of oil emulsion to lime-sulphur increased the acaricidal effect.

Steer (W.). **The Use of Derris Root as an Insecticide.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 225–227, 1 ref. East Malling, Kent, May 1936.

A brief account is given of the use of derris root as an insecticide, with notes on its application against specific pests in England. In 1934, infestation by red spider [*Paratetranychus pilosus*, C. & F.] on apple appeared to be reduced by 80 per cent. after the application of a derris spray at petal-fall, and on damsons by 92 per cent. by a spray of derris and soap, as compared with 97 per cent. by one of lime-sulphur. A spray of derris controlled a severe infestation of red currants by *Capitophorus ribis*, L., in 1935, but a derris dust was ineffective. Derris dusts are very toxic to flea-beetles and should be applied on young hop vines at the first sign of injury by them, and repeated until the plants reach the breast wire.

Sitowski (L.). **Trzmielnik (*Aphomia sociella* L.) i jego znaczenie w przyrodzie.** [*A. sociella* and its Importance in Nature.]—*Przyroda i Tech.* **15** fasc. 4 pp. 193–196, 2 figs., 2 refs. Lwów, April 1936.

Notes are given, partly based on the literature, on the bionomics of the Pyralid, *Aphomia sociella*, L., which is widely distributed in Poland and breeds in nests of various species of wasps and bumble-bees. The larvae feed on the immature stages of these insects, as well as on the wax, honey and stored pollen.

List (G. M.) & Newton (J. H.). **Insect and Mite Pests of the Peach in Colorado.**—*Bull. Colo. Exp. Sta.* no. 427, 30 pp., 16 figs., 1 ref. Fort Collins, Colo., May 1936.

Brief notes are given on the insects and mites that attack peach in Colorado, with descriptions of the types of injury caused. In addition to the more important pests, which are those common in the United States, Anthicid beetles, of which the chief is *Notoxus monodon*, F., have caused some damage to the fruits, attacking them particularly at a mechanical injury or a roughened area. A list of insecticides used on peach, with notes on their preparation, is appended.

Papers noticed by Title only.

Hodge (C.). **The Anatomy and Histology of the Alimentary Tract of the Grasshopper, *Melanoplus differentialis* Thomas.**—*J. Morph.* **59** no. 3 pp. 423–434, 2 pls., 10 refs. Philadelphia, Pa, 5th September 1936.

Ma (Tsing-chao). **A deductive Study on the Correlation of Drought and Locust Outbreaks in Kiangsu during the T'sing Dynasty.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 18 pp. 362–373, 2 figs., 4 refs. Hangchow, 21st June 1936.

Takahashi (R.). **A new Genus and Species of Aphididae [*Sinochaitophorus maoi*] from China (Homoptera).**—*Lingnan Sci. J.* **15** no. 2 pp. 197–200, 4 figs. Canton, 20th June 1936.

[Vasil'eva (N. A.) & Mal'tzeva (A. S.).] **Васильева (Н. А.) и Мальцева (А. С.). Verzeichnis der Blattläuse (Aphidodea) der Umgegenden von Woronesh und der Steppen Chrenowaja und Kamennaja.** [List of the Aphids of the District of Voronezh and of the Khrenovaya and Kamennaya Steppes.] [*In Russian.*] —*Acta Univ. Voroneg.* **8** no. 3 pp. 67–81. Voronezh, 1935. (With a Summary in German.) [Recd. September 1936.]

Roland (G.). **Etude de la jaunisse de la betterave.** [A Study of Virus Yellows of Beet in Holland, including its experimental transmission by *Myzus persicae*, Sulz., and *Aphis fabae*, Scop.]—*Rev. Path. vég.* **23** fasc. 3 pp. 185–207, 7 figs., 27 refs. Paris, 1936. [*Cf. R.A.E.*, A **24** 406.]

Neves (M.). **Sur l'existence au Portugal d'une diaspine nouvelle pour la faune de l'Europe** [*Aonidiella* (*Aspidiotus*) *tinerfensis*, Lind., on *Dracaena draco*].—*Rev. Path. vég.* **23** fasc. 3 pp. 213–214. Paris, 1936.

Goux (L.). **Notes sur les Coccides (Hem. Coccidae) de la France (14e note). Deux *Eriococcus* nouveaux des Environs de Marseille.**—*Bull. Soc. zool. Fr.* **61** no. 5 pp. 344–356, 26 figs. Paris, 12th August 1936.

Constantineanu (M. I.). **Contributions à la faune ichneumonologiques de la Roumanie. Subfamilia Ophioninae Cresson (suite).**—*Ann. sci. Univ. Jassy* **22** pp. 177–193, 3 refs. Jassy, February 1936. [*Cf. R.A.E.*, A **21** 320.]

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